DELTA METAL.

"Delta metal" is a new alloy, lately perfected by Mr. Alexander Dick, of 110 Cannon street, London, England. It is a new variety of yellow brass, but the distinctive features of the compound are the introduction of a definite quantity of iron, and the use of phosphorus during the smelting process to prevent the oxidation of the iron. The metal thus produced is as much superior to brass as phosphor-bronze is to gun metal, or as steel is to iron, while its price is not higher than that of the best brass.

Among the chief advantages claimed for this new metal are its great strength and toughness, as appears from tests made by David Kirkaldy as late as June 13: The ultimate stress per square inch that "delta metal" will bear is, rolled, 33.9 tons; rolled and annealed, 29.8; and cast, 20.9; the ultimate extension in 10 inches being 21.6, 34.7 and 19.1 per cent. respectively; and rolled into wire of 22 w. g. it is said to stand 62 tons per square inch. It can be made as hard as fine steel, and when melted it runs very freely, producing sound castings of a close fine grain; it can also be rolled and forged hot, and stands a certain amount of hammering and drawing when cold. In color it resembles that of gold alloyed with silver, takes a high polish, and tarnishes less rapidly than brass when exposed to the atmosphere.

The wide application of this metal, and its use in in engineering work and the arts, is evidenced from the exhibit of Mr. Dick in the Engineering and Metal Trades Exhibition now going on in London. Bars, rods, and wires, sheets and plates, all manner of fire engine and hydrant fittings, water and steam gauges, valves and cocks, cast screw propellers and propeller blades, cast and forged; general brass work, cabinet-makers' fittings, church and ship bells, telegraph fittings, and a multitude of other objects appear in "delta metal," and prove its practical adaptability for manufacturing purposes. One of the propeller blades exhibited is seven feet in diameter.

Its introduction to the English trade has been rapid beyond the most sanguine expectations of the discoverer, and promises to work a revolution in the employment of metals in the trades. The season tickets to the present exhibition were made in this metal, on account of its fine color.

THE UNSANITARY HOMES OF THE RICH.

The above is the title of a paper by Chas. F. Wingate, S. E., in the last number of the *North American Review*. While referring to sanitary science as being as old as the time of Moses and Hippocrates, he calls attention to the fact that its practical application has not been rapid. It is only thirty-five years since the first comprehensive health law was enacted in England. Much had been previously done to improve the condition of hospitals, prisons and factories, but domestic sanitation was neglected, and public attention is only now being turned in that direction.

He notes the surprising fact that while the evils complained of have been found in city and country, in the homes of rich and poor alike, they have been most destructive to human life and health in the finest residences here and abroad, and gives as examples the death of Prince Albert from this cause and the present unsanitary condition of the government offices and official residences in Downing street, London, and the declaration of Rawlinson, the eminent English engineer, that Belgravia is the worst sewered part of London.

Coming home to New York, Mr. Wingate states that in defects in drainage many of the costliest houses on Murray Hill rival the much talked of sanitary horrors of Baxter street. This is due, in a measure, to the covering of every available foot of ground with brick and mortar, the presence of dark and unventilated inner rooms, and the lack of conscientious and scientific supervision of the plumbing arrangements. Ventilation is a lost art, and even when a pretense of so doing is made, the evil is frequently made worse by so locating and constructing a ventilating shaft that foul and poisonous currents of air are led *into* the building. Prof. Chandler is quoted as stating that not one house in one hundred in New York has a properly constructed cellar—as a rule they are damp and badly or not at all ventilated; and the Professor explains by this the large proportions of deaths by consumption, and the prevalence of rheumatism in the metropolis.

Refrigerators connected directly with house drains by the drip-pipe; water-tanks and cisterns communicating with the soil-pipes; foul slop-sinks, and the multiplicity of servants and lack of responsibility for domestic details, are given as among the many causes of sickness and death in our wealthier homes.

While doing full justice to the conscientious plumber who thoroughly understands his work, Mr. Wingate is properly severe in his denunciations of the unscrupulous pretender, who by scamp-work and ignorance, combined with lower charges, too often drives off his intelligent and honest rival, and brings the whole trade into disrepute.

The false economy of owners and builders is commented upon, and their forgetfulness of Emerson's remark "that the difference between what is good and the best, is sometimes as great as between what is good and what is bad." The difference between the essential and ornamental is not duly considered, and health and human life is too often sacrificed for mere outward show.

The counting-rooms, offices and down-town stores come in for their share of condemnation, and the violation of all sanitary laws is in too many of them most flagrant. Basement offices over damp cellars, narrow alleys, and lofty buildings, shutting off light and air; foul plumbing fixtures, drains originally intended to carry off surface water, and now wrongly utilized for sewage, sewage gas every where, either in the building, or coming out on the roof of one to enter an adjoining and loftier structure; these are a few of the reasons given for the worn, weary, blanched and prematurely aged look of so many of our business men; and the wholesale introduction of steam for office heating purposes promises to increase the crop of evils first pointed out.

Mr. Wingate closes his article by suggesting the founding of an Association for Improving the Conditions of the Rich, and sending missionaries to diffuse sanitary tracts among this benighted class.

FEEDING THE CANADIAN PACIFIC MEN.

Now you ask what this army of men and teams eat. Step into my shoes for a day and you will get an idea of what it takes to supply all this Northwest territory, and the amount of work connected with the supply department. In the first place the horses require sixteen hundred bushels of oats daily, which amount must be unloaded from the train as near the end of the track as possible, and then loaded on freighting outfits and hauled ahead. This work alone requires a few men and teams. Now to feed this army of railroad men it requires from one to two cars per day of supplies. These supplies are the best that money will buy; our meats all come from United States, from Armour, of Milwaukee; hams, bacon, pork, corned beef and spiced roll; we also have a butcher outfit that visits each camp at least three times per week, with good fresh beef. It required last year in this line 700 head to supply us; this year it will probably require nearly 1,000 head. It requires about 300 sacks of flour of 100 pounds each per week for bread. This, of course, is all Manitoba flour, of which there is none better. We get butter from Ontario, and so far this year it has been good. Our other supplies consist of the same as your stores in Elkader keep, all kinds of canned goods. These come in car-loads; think of a car-load of canned peaches, or a car-load of canned corn. We have plenty of potatoes and onions and stale eggs. All these supplies come to me at Maple Creek, and are unloaded and made into car-load lots, such as 100 sacks of flour, 20 barrels of sugar, a quantity of meats and all kinds of groceries, such as I deem necessary for the wants of that day. This is not all, remember. We have to keep everything that is needed in a town of the same number of people. Our blacksmith and wagon repairer must all be kept ready, also hundreds of plows, scrapers and all kinds of repairs for the same. Now, then, come a drug department, where are kept all kinds of horse medicines; we also have five doctors that travel over the line constantly, for which each man pays 50 cents per month, and I will say here that these five men have all about they can attend to in the spring, as men are compelled to live in tents, and at the commencement, before the camps are properly established, men are compelled to lie on the ground for probably two or three nights, and, coming from the South, it causes a great deal of pneumonia, which has carried off a few to the subsequent beyond, but in a few more days the sickness will be slight, as the climate is healthy.

We will reach the foot of the Rocky Mountains about Aug. 10.—*Elkader (Ia.) Register.*

FEDERAL WORKS IN NEW YORK STATE.

The following is a summary of the public works now under way in this State. Among the Federal buildings, the most important is the Brooklyn Post-Office, but work is postponed until more funds are available. Buffalo has a Custom-House well under way. The building funds for Rochester, Syracuse and Poughkeepsie are also large. The island wall at Governor's Island is progressing, and the military want to have a sea wall on the west side of the island also, 2,972 feet in length and costing $75,000.

A tower 250 feet in height is to be erected at Hallett's Point for electric lighting the Hell Gate passage.

The improvement of New York is fast becoming a necessity and a matter of national importance, but the only projected works are the placing of a light on Romer Shoal, the cost of which is estimated at $35,000.

The Hell Gate works form, however, an exception, although work has been there also retarded by lack of appropriations. The final explosion at Flood Rock would have been made this fall had these been sufficient. Autumn is the only season when the operation can be performed. The cost for the explosion is put down at $420,000.

The other works now in progress in various parts of the State and the appropriations therefor are as follows: Hudson River, $4,000; Buttermilk Channel, $38,000; Echo Harbor, New Rochelle, $3,000; harbor at New Rochelle, $8,000; channel in Gowanus Bay, $10,000; harbor at Port Chester, $10,000; channel between Staten Island and New Jersey, $5,000; Sheepshead Bay, $2,000. On the lakes the following are the amounts: Buffalo Harbor, $80,000; Wilson, $5,000; Oak Orchard, $3,000; Charlotte, $15,000; Pultneyville, $2,000; Great Sodus Bay, $12,000; Little Sodus Bay, $12,000; Oswego, $40,000; Ogdensburg, $5,000; Niagara River, $1,500, and Plattsburg, $1,500.

PROGRESS ON THE PANAMA CANAL.

General Correoso was lately in San Francisco, and gave some particulars of the work doing on Panama Canal. He has been twice governor of Panama. He stated that all the preparatory work is almost completed, and that excavation has been begun. Seven thousand men are employed exclusive of clerks, etc. The expenses average $15,000 a day. Leveling the land has been begun at Culebra, the highest point. Three hydraulic dredges which were formerly in the Bay of Colon are now dredging the river Chagres, and making it navigable as far as Gatun.

This work will be finished at the end of the year There are twelve excavating machines at work at Monkey Hill, Gorgona, Emperador and Culebra. Material is transported by small steamers, by branch roads, etc. There are hospitals all along the the line, and the chief one in Panama has so far cost the company $1,000,000. Several reforms were made by C. de Lesseps on his last visit. The departure of the superior agent left the work in charge of the chief engineer, M. Demarte.au. The new superior agent, M. Richier, has, it is thought, full instructions.

CHOLERA'S THREATENED ADVANCE.

The latest advices from the East leave no room to doubt that the cholera epidemic will soon extend its ravages beyond the Mediterranean. The necessity for taking extraordinary precautions against its westward spread has been recognized by all the interested governments except the English, though English ports are most exposed to the importation of the plague. Should it break out as an epidemic in Great Britain, the difficulty of keeping it out of the United States would be very great, though it may be hoped we should escape this year. "The probability that the disease will gain a lodgment in the United States this summer," the *Medical Journal* thinks, "is exceedingly small." As a general rule, this journal says, our cholera epidemics have begun in years following a European prevalence, "so that it is rather for next year than this that the contingency of an inroad of cholera into Europe should excite uneasiness in America."

It is nevertheless the dictate of prudence that our government and all local authorities should bestir themselves to devising the most effectual means of preventing its importation to our shores, and of fortifying our seaport cities by sanitation against its spread should it be introduced.

In view of such a possibility, the first measure to be taken is a purification of the water supply of our large cities. While medical men have failed to account for the origin and march of the cholera, statistics show that a pure water supply is a great safeguard against its extension and fatality. In Berlin, during the epidemic of 1866, in the houses supplied with good water the number in which cholera occurred was 36.6 per cent., while in the houses supplied with bad water the percentage attacked was 52.3. In 1859, according to Dr. Parke, Copenhagen was supplied with good water, and, although cholera had been very severe there on its previous visits, there were then very few cases. Professor Förster, of Breslau, also shows that five towns of Silesia are entirely free from cholera, even when it has been brought to its doors, the supposed preservative condition being "a water supply brought from a distance which cannot be contaminated." A still more striking proof of the value of this precaution is the fact, cited by high authorities, that at Haarlem, Holland, in 1866, as in 1849, cholera prevailed with great intensity except in one part of the city, inhabited by bleachers, who had obtained a separate and fresh source of pure water.

It will be by no means premature for the authorities of all cities to improve the present season to secure pure water, and a larger supply of it, in anticipation of danger, and likewise to put their sewer systems in complete order. When this is done we may hope that, even should the Eastern plague reach this country, its visitation will be less extended and the disease far less fatal than it has ever yet proved.—*N. Y. Herald.*

A RAILROAD ESTIMATE.

In the curiosity shop of the Chicago Railway Exposition was a fac-simile of Stephenson's estimate of the Liverpool and Manchester Railroad. It is as follows:

ESTIMATE OF THE EXPENSES OF THE PROPOSED RAILROAD, FROM THE PORT OF LIVERPOOL TO THE TOWN OF MANCHESTER.

	£	s.	d.
Forming Excavation and Embankment	37,599	2	5
Bridges & other Masonry	16,920		
Stone Blocks at 1s. 4d. each	15,957	6	5
Chairs & Pedestals, 10 lbs. each, at £15 per ton	16,028	12	
Rails 4 lines, at 35 lbs. per yard, for 34 miles at £10 10s. per ton	61,710		
Laying, Rails & Forming Road for 34 miles, at 5s. per yard	14,960		
Fencing the Road	5,129	8	
Gates, 400 at £1 10s. each	600		
Waggons for making the Road	4,000		
Locomotive Engines, 20 at £600 each	12,000		
Boilers on the Road	1,500		
Cranes & Machinery at the Wharf	2,000		
Warehouses & Offices	25,000		
Land	100,000		
Survey & Act of Parliament	10,000		
Contingencies during the performance of the Work	26,595	10	5
	£400,000		

GEO. STEPHENSON, Engineer.

February 5, 1825.

CONCERNING SANITARY SCIENCE.

"The great physicians of our times are vastly more interested in sanitary science and hygiene than in therapeutics. They are studying anew the questions pertaining to life. They are investigating the conditions of perfect physical existence. They are giving lectures and writing books on the great art of keeping well, of developing physical force, of building up a perfect body. The questions of drainage and ventilation, of the nutritive values of the different kinds of food and the proper methods of cooking, of artificial exercise when it is necessary to resort to such expedients, the heating of houses, and the quantity and fashion of clothes that should be worn—are assuming an importance hitherto unknown. Everything that relates to the art of living so as to avoid sickness and pain, and maintain the highest degree of power and enjoyment, is invested with new importance. The physician is no longer 'a medicine man;' we send for him when ill, it is true, and value his curative services as highly as ever; but we would pay him a double fee to keep us well. He is a member of a health police, whose function it is to keep people from getting sick and hold disease at bay. And instead of killing a doctor when a patient dies, after the manner of the Emperor of China, the skill and proficiency of the physician of the future will be determined by his success in keeping his patients strong and well, and should they fall ill, he may be dismissed for a better one."

THE NEW RAILWAY ON MT. DESERT.

The Green Mountain Railway, on Mt. Desert Island, will be open to the public July 1, and four daily trips will be made after that date. The road runs from the shore of Eagle Lake, which is about 2½ miles from Bar Harbor, to the summit of Green Mountain. The plan of the road originated in Bango last winter, with F. H. Clergue. In December the company was organized, with W. B. Hayford as president, and F. H. Clergue as secretary and treasurer. The stock is held by lessees Hayford, Clergue, Charles V. Lord, Thomas L. Egery, F. W. Cram, Sumner Laughton, F. L. Laughton, F. W. Goodwin and C. F. Bragg, all of Bangor, and Payson Tucker. The work of clearing and grading was begun early in the winter of 1882-'83. In April active operations were begun with a large force of men, and June 23 the road was practically completed. The road is 6,300 ft. in length, but ascends a height of 1,270 feet to the summit of the mountain, about 1,000 feet above the sea. The grade averages 1 foot rise in every 4½ feet distance, and in one place rises 1 foot in every three. The railway is built on the same general plan as the railway up Mt. Washington, with this important exception: The road up Mt. Washington is built on trestles; on the Green Mountain road there is no trestle work. The track is laid on the ground, and over the heavy grades is bolted to the solid ledges. In one place the track runs over 500 feet on a solid ledge. The Green Mountain Railway is the third of the kind in the world, and cost about $50,000. William Nickerson was the engineer and George Jones superintended the tract-laying, while the whole construction was under supervision of Frank W. Cram, of Bangor, a very able railroad man, formerly superintendent of the European & North American Railway.

The rolling stock at present consists of one 10-ton engine, built by the Manchester (N. H.) Locomotive Works, and one observation car, seating 48 persons. The route to the summit is as follows: From Bar Harbor to Eagle Lake, 2½ miles, is traversed by means of barges or coaches; then across Eagle Lake, a distance of two miles, by steamer Wauwinet; thence by Green Mountain Railway to the top, where a hotel three stories in height has been lately constructed. The view from the observatory is the finest to be had on the Atlantic coast, combining as it does magnificent mountain, mainland and ocean views. The Maine Railroad Commissioners, Messrs. Wildes, Anderson and Mortland, inspected this railway recently. The inspection was very thorough, and the commissioners pronounced it durable and safe. Last season 7,000 people went to the top of Green Mountain, and it is expected the number transported by the new railway will largely exceed that number.—*Boston Transcript.*

SINKING PILES BY THE WATER-JET.

We translate from the *Annales des Travaux Publics* a short description of the method used in sinking the piles for the foundation of the Palais de Justice at Brunswick (Prussia):

A framework with hoisting fall somewhat similar to the ordinary pile-driver, was used in placing the pile in position ready for sinking; two tubes, each 2 in. in diameter, with the lower ends bent inward toward the point of the piles, were attached to the pile by iron staples; at the upper end each pipe was connected by a short section of rubber hose to other pipes connected with the city water-main, which water-supply was in this case under a pressure of four atmospheres. The piles usually sunk by their own weight into the hole formed by the water-jet, as soon as the valve was opened, making connection between the tubes on the pile and the water-main. To hasten the rate of settlement, a vertical iron bar 3 ft. long was set into a hole bored in the head of the pile, and upon this were placed iron weights of 200 lbs. each, as the resistance might require.

Piles 12 in. in diameter were sunk in this way to a depth of 15 ft. in 10 minutes' time. The least time required for a depth of 15 ft. was 2 minutes, the longest time for same depth was 30 minutes. As long as the water jet was in operation at the foot of the pile it was possible to give the pile a rotary motion, and thus facilitate the descent; but as soon as the jet was stopped the pile became immovable. As a proof of their stability a dead weight of 50 tons was applied to some of them, and it was found that their resistance was entirely independent of the time consumed in sinking them.

To sink 20 piles by this method required the use of about 2,000 gallons of water; 7 or 8 laborers were employed, and one gang put down from 6 to 14 piles per day.

CONVENTION NOTES.

In accordance with the old and oft times abused motto "better late than never," we give in this number of ENGINEERING NEWS a few illustrations, intended especially for the benefit of those of our readers who did not attend the 15th Annual Convention of the American Society of Civil Engineers.

The first view in order is the Hotel Lafayette, on Lake Minnetonka, the headquarters of the Society during convention week. This hotel was opened to the public for the first time on the day preceding the arrival of the members of the Society; and the clerks had not yet had time to get this really well-appointed and most excellent establishment into perfect running order. To this fact must be ascribed the various annoying features attending the midnight advent of the engineers. The building is some 800 ft. in length, rooms spacious and cool, table and attendance all that could be desired, and the long porches were especially well adapted to moonlight strolls in the company of those members of the gentler sex whose presence made this convention memorable.

Lake Minnetonka, upon the banks of which the Hotel Lafayette is situated, is a beautiful sheet of water, so cut up by wooded islands, jutting points and narrow channels, that the scenery presented on a trip throughout its length of 30 miles is ever-changing, but always beautiful. There are fish, too, beneath its glancing surface, hungry pickerel, and fine looking bass; and some of the members with true engineering instinct, ran a line in their direction, and located more than one scaly mess.

The business meetings of the convention were held in the State capitol at St. Paul, a building that does much credit to a city that is only one generation old. It is in keeping with the many other elegant structures, both public and private, that adorn this thriving city, and is typical of the general energy and prosperity of the grand Northwest.

The annual address was delivered at Minneapolis, in the opera-house, a building which for completeness of design and attention to personal comfort in the detail of its interior could serve as a model to the builders of theatres elsewhere. Of the city of Minneapolis itself we can only say that though younger, it is a most lusty rival of its neighbor, St. Paul. The Falls of St. Anthony gave it birth and keep it alive with its stored power and wealth-producing music.

One of the most interesting papers read before the convention was devoted to the detail of the preservation of these Falls. They were rapidly wearing themselves away and threatening the entire destruction of the industries gathered upon its banks when the engineer was called to the rescue, and he, by wooden shield, and timber crib, and artificial rock of unyielding cement, checked this erosive action and presented a barrier to wear that even the rushing waters of the Mississippi must respect. Little did those engineers think who heard this paper read by Major Farquhar, the able engineer who devised and successfully carried out this scheme of preservation, that in scarcely ten days from that date they would be called upon to mourn the death of the apparently strong man who stood before them.

The remaining sketches are the results of a flying trip to Winnipeg, the capital city of Manitoba. As will be noted, the scenery alone the line of the Minn., St. Paul & Manitoba Railroad is somewhat monotonous; there is much of a sameness in it. But it is upon these boundless prairies of the Valley of the Red River of the North, the future granary of the world, that the traveler is most vividly impressed with the extent of our landed possessions and the superabundance of "elbow-room" yet remaining within our borders. Earth and sky melt in seemingly endless level lines, miles away to either side; it is an ocean of land, and the occasional distant clump of trees, marking a water course, and the scattered houses of lonely settlers, help out the illusion by suggesting islands and far-away ships.

The seekers after knowledge from the East would naturally expect to find a wilderness of the original type, when rambling a thousand miles north of Chicago, with an occasional Indian decked out with the feathers, paint and deerskins, made so familiar and dear to us by the Leather-stocking tales of Cooper. We blushingly confess that some such idea impelled us in the direction of mysterious Manitoba, of signal-service fame; but our dreams were to be rudely dispelled; we found, instead of the picture fancy painted, matter-of-fact railroads, frequent and busy towns, an energetic bustling race of traders and speculators, lofty granaries and farms, whose owners counted their fields of growing wheat by square miles and not by acres. We found in Winnipeg a city of 30,000 souls, with streets lighted by electricity, and enlivened by the tinkling bells of the horse car; with massive and imposing public buildings, and stores that could supply the wants of the most exacting, even to the latest novel. We found all this, where in 1870, excluding the military at Fort Garry, there were only 215 white people in the entire province of Manitoba; and we saw the man who bought the town site of Winnipeg for an old wagon and two mules. The wilderness we expected to reach was there only a decade ago, but the railroad, that synonym of progress, had been ahead of us.

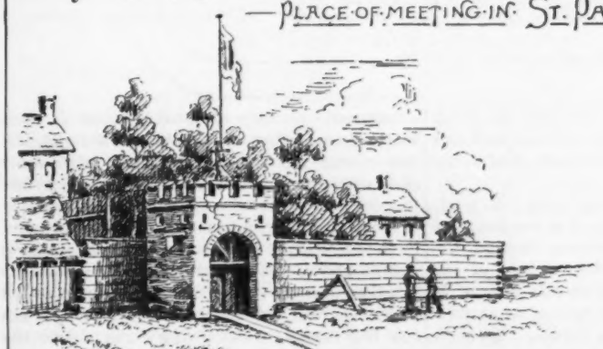
We found our Indians too, but they were most degenerate sons of the forest; stove-pipe hats, dirty calico shirts and cast-off clothing of the whites had supplanted the plumed head-gear, buffalo hides and deer skins of their ancestors; their chief source of income seemed to be pennies, either begged directly or stuck up in a crack in the board walk, to be shot at with a clumsy bow and blunt headed arrows; their chief investments were in the direction of rum and

HOTEL LAFAYETTE LAKE MINNETONKA HEAD QUARTERS of the SOCIETY

MINNESOTA STATE CAPITOL

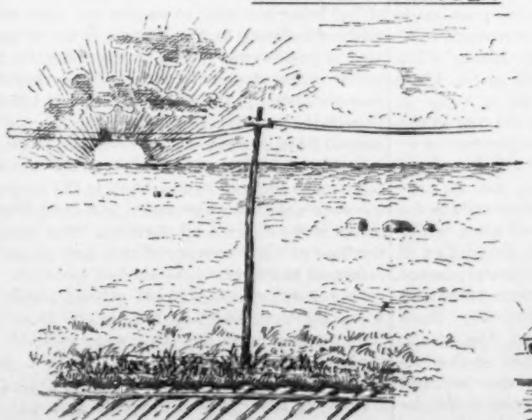
PLACE OF MEETING IN ST. PAUL

THE OPERA HOUSE PLACE OF MEETING IN MINNEAPOLIS.

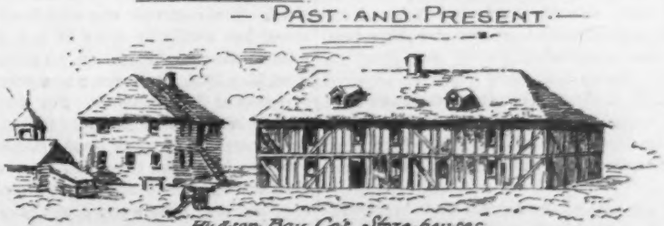


ENTRANCE TO FORT GARRY WINNIPEG MANITOBA

WINNIPEGERS. PAST AND PRESENT



SCENERY ON THE LINE OF THE M. ST. P. & M. R. R.



Hudson Bay Co's Store-houses Fort Garry, Winnipeg.

CONVENTION NOTES

tobacco, but they evidently wasted no money on soap, or combs of the fine tooth order.

Another familiar and striking figure about the Canadian Pacific Railroad Depot was the freshly arrived Englishman, a tourist or prospector, may be a settler come to stay. Judging from the baggage carried, many of these men, like ourselves, expected to get far beyond the pale of civilization in coming to Winnipeg. We noticed one party in particular, equipped with leather hat box, gun-case, portable bath, lap-rugs and gum blankets, a lunch-basket, and bundle of canes and umbrellas; a traveling-bag slung over one shoulder and a flask over the other; surely impedimenta sufficient for one traveler.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 334.)

DXLIII.—BENICIA, CAL.

Benicia, California, in lat. 38° N. long, 122° W., on the straits of Carquinez, is on hilly ground, sloping to the water's edge, with salt marsh for one mile and low bluffs for two miles on the shore.

Settled in 1847, it was incorporated a city in 1850. Water-works were built by a private company in 1880 after plans of F. A. Gibbes, C. E., taking the supply from Sulphur Spring Valley Creek, which has a water shed of 15 square miles. An earth dam 26 ft. high and 280 ft. long with top width of 30 ft. and slopes of 2½ and 1¼ to 1, forms an impounding reservoir, from which the water is pumped 200 ft. by a No. 10 Knowles steam pump into circular basin holding 250 gallons, whence it is conveyed through 12,000 ft. of 7 inch wrought iron riveted pipe of No. 14 iron, to a reservoir in the city. It is a circular basin 155 ft. in diameter at top and 15 ft. deep, containing 1,200,000 gallons at 192 ft. above tide level.

Distribution is by about 10 miles of wrought iron pipe, of 7 to 2 in. diameter. The 7 in., 5 in. and 4 in. pipe are riveted pipe of No. 14 iron. There are 20 fire hydrants, 6 gates, 250 taps and 15 meters. The city pays $400 per year for 16 hydrants. Service pipes are of wrought iron, some plain and some coated.

The population in 1880 was 1,794. It is now said to be 2,500. The daily consumption in 1882 was 100,000 gallons.

The capital stock of the company is $150,000. The works have cost $79,000. There is a bonded debt of $30,000 at 10 per cent. interest. The expenses in 1882 were $8,000, and the receipts about the same. The pump-house was burned and rebuilt in July, 1881. There is a slight leakage through the dam.

Samuel C. Gray is the Secretary, and Isaac A. Skinner, the Superintendent.

CORRESPONDENCE.

NEW YORK & CONNECTICUT AIR-LINE RAILROAD.

NEW HAVEN, Conn., July 16, 1883.

EDITOR ENGINEERING NEWS:

In your issue of the 14th I notice an item in "News of the Week," which requires correction.

The Connecticut Railroad Commissioners did *not* approve the location of the New York & Connecticut Air-Line Railroad. In rendering their decision the Chairman, Hon. Geo. M. Woodruff, said: "The inaccuracies claimed by the opponents of the petition are in part admitted by the witnesses of the petitioners. Mr. Bacon (the engineer member of the commission) has gone over the description of the entire line—each course, distance and curve—and finds it an impossible line, and the location, as it is now described, can *not* be approved by the Commissioners." The line was divided into three sections. The middle section, from the Saugatuck River westward, about 15 miles in length, was *absolutely rejected*, and the petitioners were allowed to amend the other two, as the errors therein existing were considered unimportant. But an entire new location is required of the middle section. The Commissioners have not as yet *examined* any part of the New York & Connecticut Air-Line, while they have been over nearly the entire line of the Hartford & Harlem Railroad.

There are so many false reports made in the interest of the "Air-Line"—evidently for the purpose of bolstering up the concern and to throw discredit on its healthy young rival, the "Hartford & Harlem," that it is about time a little *truth* should be known abroad. Yours truly,

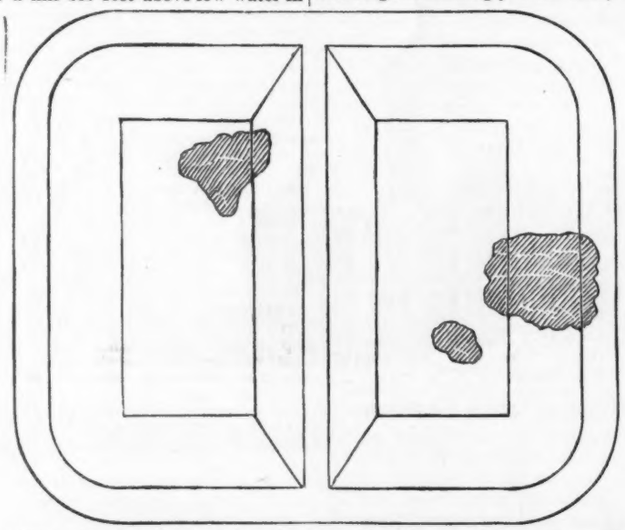
ONE WHO KNOWS.

THE BROKEN RESERVOIRS AT KNOXVILLE, TENN.

KNOXVILLE, Tenn., June 17, 1883.

EDITOR ENGINEERING NEWS:

DEAR SIR: Mr. M. T. Davidson, of Brooklyn, N. Y., who was present at the opening of the Knoxville Water-Works, and witnessed the accident to our reservoir, informed you at the time of its occurrence that I would forward at once plans and drawings of the reservoir, and the break in its bottom. The second break, this time in the other division of the reservoir, together with the demands upon my time occasioned by our attempt to at once repair the damage, prevented my immediately fulfilling the promise made to him. I now inclose to you a plan of the reservoir, with sections through the two openings, showing as near as possible the depth and general appearance of breaks, and also take the liberty of making the following statement of the facts connected with the case: The reservoir at Knoxville is built upon the summit of a hill 232 feet above low water in the Tennessee River. It is the highest of the seven hills upon which the city of Knoxville is built, and is about 60 feet above the next highest point in the city.



From the crest of the hill the ground falls gradually away on the north and west to the banks of First Creek, a small stream flowing through the heart of the town. After passing the base of the hill to the north, the channel of this stream is broken and rocky, and several springs occur in a distance of 2,500 feet from its mouth. Through these springs and into this creek, through openings in its rocky bed, was discharged the water from both divisions of the reservoir, situated over two-hundred feet above it. The excavations made while building the reservoir were in a tough, tenacious red clay. Solid and unyielding when pure, but crumbly and friable in some places, where mixed with loam or a small quantity of sand. It was considered excellent material, and the entire reservoir was puddled with selected portions of it. In no part of the reservoir was any indication found that the ground beneath was not as solid and unyielding as any foundation that could be desired. The reservoir was completed some weeks since, but owing to delay in the completion of work at the pumping station, no water was pumped until May 28th, when water was pumped into both divisions at the same time. For three days there was no indication of anything wrong. The settling and absorption of water by the puddle in the bottom was much less than had been expected, and after allowing for waste through pipes, hydrants, etc., but very little water could have left the reservoir through the bottom until the moment of the break. At seven o'clock on the evening of the 31st the watchman on the reservoir bank noticed a small swirl on the water of the north division; this increased rapidly, and in ten minutes from the time it was first noticed over half a million gallons of water had been emptied from the reservoir, carrying with it some two hundred yards of earth puddle and broken rock. The opening is, as shown on plan, approximately 20 feet square, and extends about ten feet into the side of the division wall. The channel seemed a short time after the break to be clear and unobstructed, but a heavy shower during the night washed the cracked and broken edges into it, and filled it to within twelve feet of the bottom of the reservoir. The next day work was commenced, removing the loose earth and débris with which the opening was clogged, and has developed the following: At twenty feet depth a ledge of soft limestone is found, seamed and pierced in every direction with crevices from six inches to a couple of feet in diameter, most of which are tightly filled with material washed from the surface of the bottom of the reservoir. So far no clear opening has been found sufficiently large to admit the body of a man, and owing to the limited number of men able to work at one time in the pit our progress is necessarily slow. Above this ledge of seemingly solid rock, was found a considerable quantity of loose boulders of from two to six cubic feet, contents which had evidently lain nearer the surface and only fallen when their supports crumbled beneath them. They had supported an arch of clay and thin shale apparently of some ten or fifteen feet span, which, moistened by the filtration of the water, gave way beneath the weight above. A careful examination failed at this time to discover any signs of damage to the south reservoir, and the work of the pumps was not interrupted, water being pumped into the south division to the depth of eleven feet, or one and a half feet below the leveling pipe. The water was kept at this level until Monday, June 4, the object being not only to supply the pipe system without resorting to direct pressure, but to test as well as possible the bottom of the reservoir. Monday morning at eight o'clock a small depression was discovered in the south bank which looked as though the puddle beneath the brick paving had slipped from its place and allowed the outer surface to settle. This, when first seen, was about ten feet square and two feet in depth in the portion of the slope not covered by water, and extended two-thirds of the distance up the bank. The water at the time of the discovery of this new break was measured and found to be ten feet in depth. Ten inches of water, about 71,000 gallons, passed out when the bank first began to settle; from then until the final break but little water escaped. At twelve o'clock the edges of the depression began to crumble, and at quarter past three o'clock the bottom and lower edge of the slope gave way, and over three hundred yards of earth sank entirely out of sight. The water poured into the break and followed it with great rapidity, washing in additional earth from the edges of the opening, and

the entire amount of water contained in the reservoir passed out in about twelve minutes. While the larger portion of the water was passing out, a view could be obtained of the opening through which it issued. It had almost the precise appearance of a funnel, the lower end vertical beneath the inner top of the reservoir bank, and the larger top spreading upward and outward to the dimensions shown on plan at "D." The water could be seen nearly sixty feet below the crest of the bank, rushing through an opening about five feet in diameter, the lower end of our vertical funnel. No rock could be seen in the sides or bottom of the opening while the water was passing out, and it was soon nearly filled by the masses of earth which crumbled and fell in after the greater part of the water had passed out. This earth seems to have effectually stopped the fissure or crevice, for since the breakwater has been pumped into that division of the reservoir, and so far but little has passed out. No explorations have yet been made in the south division of the reservoir, our intention being to fill and effectually stop the hole made in the north division first. This will give us ample storage capacity until the larger break can be investigated and repaired.

Very respectfully,

E. F. FULLER,
Eng. Knoxville Water Co.

A STEEP RAILROAD.

208 South 3d St., RICHMOND, Va., July 16, 1883.

EDITOR ENGINEERING NEWS:

In your issue of June 2, there is an article headed "A Steep Railroad." Some months since I had the pleasure of riding up a steep traction railroad to the coal mines about four miles from Hawks Nest on the Chesapeake & Ohio Railroad, in West Virginia. Mr. W. N. Page, the financial agent of the Victoria Furnace at Goshen Bridge, Va., which controls the above mentioned railroad and mines, told me that "he built the 30-inch gauge railroad at Hawks Nest with two miles of uniform grade of 6 44-100 per 100 ft., or 338 ft. per mile, with a maximum curvature of 22°, balance of road is 250 ft. per mile, and this road has been successfully operated since 1876. Yours truly,

JNO. T. PRICE, C. E.

DISPOSAL OF CITY REFUSE.

YOUNGSTOWN, Ohio, July 17, 1883.

EDITOR ENGINEERING NEWS:

Will you kindly let me know how the garbage and ashes are removed from your city, and what disposition is made of the offal, also the kind of sweeping machines used.

Very respectfully, J. M R.

[The garbage and ashes are placed in boxes and barrels on the sidewalks, and removed *daily* by the carts of the Street Cleaning Department, which haul them to the nearest department dock, where they are dumped on scows; and these scows are towed out to sea in deep water and there emptied.

The street sweepings are disposed of in a similar manner.

The offal, such as dead animals and diseased meat comes within the province of the Health Department, which lets out by contract to certain parties the removal of this material from the entire city. For this present year this work is done for $40,000. The offal is taken by the contractors to Barren Island and then converted into fertilizers.

Two kinds of street sweeping machines are used, one made by the Chapman & O'Neil Manfg. Co., at No. 291 Avenue C, New York; and the other called the "Boston Machine," is made by the Abbot-Downing Manfg. Co., of Concord, Mass. A single-horse machine costs about $350 to $400.—ED. ENG. NEWS.]

THE ELECTRIC LIGHT IN MINES will, it is said, be largely used in Arizona. Among other companies, the Silver King Mining Company, the Howell Smelting and Conger Mill and Mining Company will use it. At the Silver King Mine, four 3,000 candle-power Brush lights will be used above ground, and two below, along with 25 incandescent lamps.

ELECTRIC LIGHT SPECULATION AT LONDON.

Electric light shares, which last year rose to fabulous prices, are well known to dave fallen again to a ruinous extent for those who bought during the mania. So long as the public were inclined to buy, the contest between those in the market who had money and those who had stock was a very unequal one. The command of money was limitless, and prices rose. After a time the rise ceased, and then came a collapse. Every now and then since the collapse there have been passing signs of another "rig," although nobody can expect to see such a rise as took place when the whole thing was new and nothing about the electric light was calculable in advance. Hammond shares, for instance, which rose to 20 or thereabout, when the mania was in action, had lately dropped to par, which is 2½ per share; but dealers and outside operators who had been successful in selling the shares continually all the way down, to use their own expression, have not known when to stop, and are now caught by a rise, and are without the shares they had contracted to deliver. The price has advanced to 4, mainly or solely because the current settlement disclosed a scarcity of shares. In a word, the possessors of money have the non-possessors of shares again to some extent at their mercy. All electric companies expect to do better business when the autumn comes on and the pending provisional orders for local bodies are passed, but that is the immediate cause of the rise.— *Pall Mall Gazette.*

NEW METHOD OF LAYING RAIL.

John M. Reid, of Allegheny City, has patented a design for laying steel or iron railroad rails that he claims will forever bar accidents caused by ditching of trains through the expansion or contraction of rails by heat or cold. The object of the invention is to produce a better railway, more reliable and safer than heretofore and without lateral or vertical motion. Instead of wasting so much timber in the ties, Mr Reid proposes to have only 900 ties per mile of single track, and these need not be more than seven feet long by five inches square. He then lays timber cushions or beams under both rails, lengthwise, twelve inches deep by six inches thick, the beams having a lengthwise groove to receive the diaphragm of the rails, completing both ties and cushions with not more than 6,300 feet of preserved wood. The crown or upper part of the rail, which is subjected to friction, is made much heavier than usual, the base is made broader, with a diaphragm below to resist lateral pressure. A safety-stay coupling made of cast steel, is fitted and inserted in the abutting ends of the rails. These are held down by heavy screws in the wood cushion beneath. In addition to the safety guarantee in this invention, it is claimed that it is cheaper and can be kept in in repair for much less cost than any other method in operation. It will be noticed that Mr. Reid's device is much the same as that of Thomas Johnson, Vice-President of the Indianapolis Street Railway. The track laid about one year ago, on North Illinois street, is similar to that which Mr. Reid has secured his patent on.

A PERUVIAN RAILROAD.

The traffic manager of the Arequipa, Puno and Cuzco Railroad Company, Mr. MacCord, was lately in Chicago, after a residence of fifteen years in Peru. He gave some interesting details concerning the road with which he was connected. It extends from the coast town of Moliendo to Lake Titicaca, a distance of 325 miles, the lake being 12,505 ft. above the level of the sea. The road contains many heavy grades, the average rise being about 211 ft. to the mile. It is equipped with rolling-stock of American manufacture, and is of the standard gauge. The passenger rates are 8 cents per mile, and the freight tariff from the seaboard to the interior is calculated upon a basis of 1 cent per 100 pounds per mile. The rate from the interior to the seaboard is less expensive. Owing to the heavy grades, short trains are run. Mr. MacCord speaks of the road as a triumph of engineering skill. It rises 2,200 ft. in sixteen miles, and upon the side of a mountain the track appears three separate times upon road-beds cut out of the solid rock, rising one above another.

The gentlemen left Arequipa about six weeks ago, and says there had not been much improvement in the condition of the Peruvians during the last fifteen years. There was no guarantee offered for capital in Peru, and, as a natural consequence, moneyed interests were loath to seek investments in the rich mines with which the coast abounds. In some provinces of Bolivia thore were mines which yielded 60 per cent. of pure silver. Everything was imported; flour coming from Chili, and selling at $8 per 100 pounds. The foreigners were in the main Germans, English, French and Italians, the laborers coming from the latter nationality.

MEXICAN RAILROADS.

The *Mexican Financier* gives the following list from official sources of the railroads completed in Mexico up to the end of April.

	Miles.
Tlascala Railroad	2.50
Orizabia-Ingenio	3.00
Nuetla-Tlasciaco	3.75
San Andres	7.00
Tlalmanaico	9.00
Pueblo & Matamoras Lucar	19.00
San Martin	23.00
Tehuacan-Esperanza	31.00
Tehuantepec	31.00
Sinaloa & Durango	36.00
Vera Cruz-Medellin	39.00
Hidalgo Railroad	56.00
Pueblo San Marcos	57.00
Yucatan lines	68.00
Mexico-Tlalpulalpam	75.00
Sonora Railway, Guaymas to Nogales	234.00
Interoceanic, Mexico to Cuantla and branches	183.00
Mexican National, Mexico to Acambaro 178.00	
Laredo southward 208.00	
Branches 87.00	473.00
Mexican Central, Mexico to Lagos 511.00	
Paso del Norte to Chihuahua 302.00	
Tampico to San Luis Potosi 62.50	675.50
Mexican Railway, Vera Cruz to Mexico 264.00	
Puebla & Jalapa branches 89.50	353.50
Total	2,379.25

The table foots up 2,379¼ miles, although the *Financier* gives the total completed road at 2,437 miles. The Mexican National, the Interoceanic, the Hidalgo and the Yucatan lines are narrow gauge, the rest standard gauge. A number of the shorter lines given above are worked by horse-power, and some of them have been in existence a long time.

THE CHINESE AS RAILROAD LABORERS.

The Chinese are usually regarded as docile railroad hands, but a strike now going on on the line of the Oregon & California road, shows that John is becoming aware of his power. This road, which is to connect with a branch from Portland now building by the Villard company, is being constructed by the Central Pacific Company. About 7,000 Chinese were furnished by the Six Companies of San Francisco, to carry on the work, They were to be paid $1 a day and board themselves. They struck a few days ago for $1.15 a day with the privilege of buying their provisions where they could get them at lowest rates. It is alleged that the firm of Sisson & Crocker having the monopoly of furnishing supplies to railroad hands on the Central and Southern Pacific—charged the Chinese from one-third to three times as much for food and clothing as the same articles could be bought for in the stores of Shasta, and naturally the Celestial, always eager to buy at the lowest rates, rebelled. The strikers are said to be backed by the Six Companies in their demand, and threaten to fight it out. The railroad company is equally stubborn, for it is not compelled to complete the road at any given time. So the present prospect is that rail connection between San Francisco and Portland will be indefinitely delayed.

COPPER IN THE UNITED STATES.

At an extraordinary general meeting of the Arizona Copper Company (Limited), which was held in Edinburgh lately under the chairmanship of Sheriff Guthrie Smith, some very interesting statistics in reference to the production and price of copper in the United States were mentioned by Mr. James Duncan Smith, S. S. C., one of the directors of the company, who had just returned from a visit to the company's mines and smelting works. Commencing with the year 1872, when the production of copper in the United States was 28,000,000 lbs., he said it had risen to 88,000,000 lbs. in the year 1882. Over the eleven years the quantities produced were as follows:

Year.	Quantity. Lbs.	Year.	Quantity. Lbs.
1872	28,000,000	1878	43,000,000
1873	31,000,000	1879	46,000,000
1874	34,000,000	1880	57,000 000
1875	37,000,000	1881	70,000,000
1876	40,000,000	1882	88,000,000
1877	42,000,000		

The consumption of copper in the United States in 1872 was 34,000,000 lbs., and the quantity went on increasing until last year, when the consumption was 77,000,000 lbs. At first it was necessary to import copper, but almost nothing has been done in that direction for several years. The great increase in consumption commenced in 1880, when it reached 62,000,000 lbs., as against 34,000,000 lbs. in 1872. This was due to the development of electric lighting business—62,000,000 lbs. in 1880; 63,000,000 lbs. in 1881; and 77,000,000 lbs. in 1882. The average price in 1872 was 35 cents per pound, and, taking the following years, the averages ranged as follows: 27, 22½, 22, 20, 18, 16, 18½, 20, 17½, and last year, 18½ cents. The highest price last year was 20⅛ cents, and the lowest 17⅝ cents per pound.

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MISSOULA, Montana, July 16.—COL. WASHINGTON DUNN, railroad contractor, was found dead in a Pullman sleeping car last night. He was en route to Portland. He leaves a wife and two children at Lock Haven, Penn. He was 45 years old. He was very wealthy, and had a contract for 200 miles of grading on the Northern Pacific. His body will be embalmed and sent East.

ALTHOUGH the condition of general business by no means warrants the idea of strikes, yet the usual summer epidemic seems to be preparing. Certainly, the working classes have grievances, and outside of capitalists and that interesting class of people who live "on the interest of their money," we all belong to it, but there is a time for all things, and neither telegraphists nor bricklayers are the worst paid people in the community. Any general system of strikes at the present time will precipitate a great deal of what is known as "shutting down."

The telegraph strike has been succeeded in Chicago by a movement among the telephone men—the climbers, repairers and instrument men. The wages of these men is small—two dollars per day. The bricklayers in Kansas have struck for $4.50 per day—life might be endurable even on four dollars per day with provisions cheap, and hundreds of thousands of workmen—bakers, shoemakers, printers, editors and tailors, have to make ends meet on one-half or two-thirds that amount. Very little sympathy either can be felt for the striking cigar makers—who are as a body non-Americans in sentiment and nationality; and who cannot hear that another "union" of cigar makers should be allowed to work alongside them.

Building operations may be interfered with for a time, but there is a tendency at present to reduce expenses in most lines, and this being the case, it is most inopportune to run against "the winds and waves."

JUDGMENT was rendered by the officiating Judicial Commissioner of Rangoon, on the 21st of May, in the suit of GRAHAM SMITH, Civil Engineer, *vs.* The Port Commissioners of Rangoon. The plaintiff in this suit sued for damages for wrongful dismissal from the post of Port Engineer, claiming that the advertisement for an engineer inserted in *Engineering* in July, 1881, implied a five years' engagement for good service, as the salary was stated to be rupees 1,000 per month, rising by annual increments to rupees 1,500 in five years. The defendants dismissed the plaintiff on six months' notice. A clause to give them that power, had been inserted in a letter which reached the plaintiff on the eve of his departure from London. The plaintiff considered that the letter was canceled, as it was dated four days previous to the date of a telegram sent him stating that there was "no letter," and it was in the post at the time. The said letter had not been referred to subsequently by either party. His honor ruled that the contract stated in the advertisement did not mutually bind the parties to each other as master and servant for any definite period. Likewise he held in regard to the 2d issue that the defendants could not legally impose on plaintiff the new condition laid down in their letter of November 8, 1881, and dismissed the case, ordering each party to pay its own cost. The judgment was concluded by the following recommendation: "The court has now disposed of each and every issue in the case, and it now only remains for it to pass its decretal order; but before doing so it thinks proper to point out to the parties that this is essentially a case in which they should try to settle their differences amicably. Whatever may be said with reference to the first, third, and fourth issues, the court is confident that the conclusion arrived at by it with reference to the second issue is correct. If it is correct it is obvious that the defendants, even according to their own interpretation of the advertisement contract (as expressed in para. 7 of their written statement), have acted illegally by dismissing the plaintiff on the first of May instead of the 7th of December, 1883. This being so, they should reconsider the situation and either restore the plaintiff to his post or try to offer him such terms as they may be willing to give and he to accept. The plaintiff, on his side, as he acted in a somewhat unbusiness-like manner inasmuch as he did not clear up the doubts which arose from the letter received by him from his employers, should not be disinclined to a compromise on reasonable terms."

A WORD OF ADVICE TO READERS BUT NON-SUBSCRIBERS.

We are induced to write as we do by a too prevalent tendency among a certain class of "economists" to make one copy of a paper do duty among many readers. One party answers our canvasser, that he reads the paper at his Engineers' Club, or in the public library, hence will not subscribe; another, that his Chief Engineer gets the paper, and that answers for the office; and another still borrows the NEWS from his wiser and more liberal-minded brother Engineer.

This is all wrong, especially from the standpoint of the publisher; and is a short-sighted policy on the part of the borrower. To be successful, and to do the greatest good for the profession to which it caters, a class paper demands the substantial support and patronage of the special class to which it devotes its pages. Without this support, it cannot properly cover the field of journalism to which its columns are dedicated. Professional pride should induce the Engineer to do all in his power to foster and advance the standard of his class organ; and the slight tax and personal effort required on the part of the individual to bring about the desired end, makes the lack of encouragement a reproach and a shame to the individual.

The profession of Engineering, as the term is now used, is of modern growth; in no other is the change in practice so rapid and so radical, and the importance of a properly conducted class paper so apparent. The Engineer of to-day must watch closely the progress of events, and keep himself well posted on the professional work of his brethren at home and abroad; otherwise he will speedily be left behind in the race for fame and fortune.

American Engineers are noted for bold and successful practice; and the extent of our territory and the conformation of surface is such that each new enterprise gives birth to yet another and perhaps bolder feat of engineering than any that precede it. With this experience to glean from we have the material for making an engineering newspaper that will exceed in the practical value and novelty of its contributions anything attempted in other lands. But to properly describe and illustrate all new and important enterprises so that the many may be benefited by the experience of the few; to enlist the best professional talent in the preparation of special articles; to abstract from the press of the country *all* that is of interest to the Engineer; requires a very heavy expenditure of means, and the untiring labor of a well equipped editorial staff.

ENGINEERING NEWS is now on a sound paying basis, the result of ten years of unwearying labor, in the face of many discouraging features; and with the experience of these past years, and the knowledge gained by that experience of what is really wanted, and how the end can best be accomplished, stands ready and well prepared to enter upon this more extended field. It is our ambition and our aim to make a paper that will do credit to a profession so important to the world's progress as the science of Engineering; but to fulfill our ambitions, we need and must respectfully ask the increased support and encouragment of that class who in the end will receive the benefit.

The above expressions are especially directed to those who furnish us with our text; to the very respectable list of subscribers who take sufficient interest in their profession to pay for their own paper, we return our hearty thanks, and promise to do all that our ability and means will permit to make our journal still more worthy of their patronage.

THE KANSAS CITY ENGINEERS' CLUB.

The Kansas City *Times* of the 14th inst. says: "The constitution of the Civil Engineers' Club of the city was filed for record yesterday in the office of the Recorder of Deeds. The officers of the Association are Daniel O'Flaherty, President; Robert Gillham, Secretary, and John Donnelly, Treasurer. The object of the Association, as stated, is as follows:

Its objects shall be the professional improvement of its members, the encouragement of social intercourse among men of practical science, the advancement of engineering in its several branches, and the establishment of a central point of reference and union for its members. Among the means to be employed for obtaining these ends, shall be periodical meetings for the reading of professional papers and the discussion of scientific subjects, the foundation of a library and the publication of such facts of the proceedings as may be deemed expedient.

CAUSES FOR THE BAD QUALITY OF SCHUYLKILL WATER IN JANUARY, 1883.

Among other papers, the July number of the *Journal*, of the Franklin Institute, contains a valuable investigation by Prof. A. R. Leeds, of the Stevens Institute, "of the circumstances affecting the potability of the Schuylkill (Phila.) water supply in the month of January, 1883." At the date mentioned, the water in the Schuykill River at Philadelphia suddenly became most offensive to taste and smell, and an examination was ordered by the Water Department of Philadelphia.

Prof. Leeds was restricted by his instructions to causes other than that of pollution, which could be determined by direct observations; it was conceded that the Schuylkill was a sewer and factory polluted stream, consequently a thorough search within the narrow field of laboratory analysis was necessitated. Samples were collected for a distance of thirty miles of river above Philadelphia, and carefully analyzed.

At the time when the examination was made and there was the greatest complaint against the character of the supply, the surface of the river was covered with ice. The temperature of the water was found to be one degree Fahr. above freezing point at the surface, and $1\frac{1}{10}$ degrees above at the bottom, showing a colder stratum flowing immediately beneath the ice, and a warmer and probable slower moving stratum at the bottom.

As a result of the analysis of the samples we have the following: Of free ammonia, there was 0.009 to 0.02075 in 100,000 parts; a greater quantity than that found in the same water in June, 1881 when it was 0.001 parts. Of albuminoid ammonia, or nitrogenous matter as yet undecomposed, but capabl

of undergoing decomposition, there was 0.01175 to 0.02875 in 100,000 parts. Yet these proportions, with the exception of one sample, are not so great as in June, 1881, when this water supply was ranked as third in order of purity among the water supplies of the principal cities in the U. S.; in other words, the nauseous taste of January, 1883, cannot be ascribed to this cause. There was no peculiarity in the organic matter itself, which would account for the taste and smell; but there was a striking peculiarity in the nature of its decomposition, inasmuch as *the free ammonia exceeded the albuminoid in almost every sample;* that this is anomalous, will be seen by comparing these analyses with those of the various city waters in the U. S., made in June and July, 1881.

	Free ammonia parts per 100,000.	Albuminoid ammonia parts per 100,000.	Ratio.
Philadelphia	0.001	0.018	1:18
Boston	0.013	0.061	1:5
New York	0.0027	0.027	1:10
Brooklyn	0.00075	0.00825	1:9

That the nauseous taste and smell was not due to the mere fact of an excess of decomposable organic matters is rendered still more probable by the small percentage of oxygen required to effect this oxidation. It is little more than one-fourth of the amount of oxygen required on June 24, 1881, when the water was excellent in taste and smell.

Nitrites and nitrates were present in large amounts in all the samples; their origin due either to the direct oxidation of the nitrogenous organic matter, or they were formed at the expense of the nitrates already existing, by their reduction in presence of excess of readily oxidizable organic matters. Their large percentages indicate in these samples a retarded or arrested oxidation.

COMPLETE ANALYSES OF THE SCHUYLKILL WATER SUPPLY.

	Pottstown, January 10, 1883.		Fairmount, January 9, 1883.	
	No. 226.		No. 228.	
	Parts per 100,000.	Grains per gal.	Parts per 100,000.	Grains per gal.
Lime	3.593	2.095	3.520	2.053
Magnesia	1.514	0.884	1.034	0.603
Oxide of Iron and Alumina	0.134	0.077	0.264	0.154
Ammonium hydrate	0.019	0.012	0.040	0.023
Sodium chloride	0.590	0.344	0.930	0.542
Potassium chloride	0.180	0.105	0.187	0.109
Carbonic anhydride	0.780	0.455	0.710	0.404
Sulphuric anhydride	2.300	1.341	1.890	1.1
Silicic anhydride, and insoluble matters	1.289	0.752	1.950	1.137
Phosphoric anhydride	trace	.....	trace	
Nitrous anhydride	0.008	0.005	0.008	0.005
Nitric anhydride	0.560	0.327	0.640	0.373
Inorganic matter	10.968	6.393	11.173	6.523
Total solid matter in solution	18.000	10.497	18.500	10.789
Organic matter (by difference)	7.032	4.104	7.327	4.266

The percentage of chlorine is somewhat high, and relatively higher at Fairmount than at Roxborough, Norristown, and Pottstown, higher up the river.

Of total solids the examination showed that in Jan., 1883, there was $\frac{1}{3}$ part in 100,000 more in the water at Fairmount Dam than in the upper part of the river.

There were three important facts to be considered in noting the condition of the water in January, 1883, viz.:

1. The small rainfall in October, November, and December, and the very small flow of the river.

2. The emptying of the Schuylkill canals, and eleven dams thereon.

3. The complete covering of ice on the Schuylkill River, the dams, canals, and tributaries.

As noted before, the amount of oxygen in freshly collected samples was much less than that which should have been present in the case of water completely aerated. The largest volume in any sample was $5\frac{44}{100}$ cubic centimeters in a liter of the water at 15° C. A liter of distilled water, artificially aerated by a current of filtered air contained $6\frac{41}{100}$ cc. of oxygen.

Potable water should have a neutral reaction. This was not the case with the Schuylkill water. It was decidedly acid in its upper portion (January 10), less so in its lower portion (January 9), and between January 9 and January 13 its reaction changed from acid to alkaline. Six days later, when, from all accounts, its taste and smell had much improved, it was neutral. In other words, the influence of the limestone waters flowing into the Schuylkill were more pronounced on January 13 than the influence of the acid waters, emptying into the stream in its upper portion at points above where the limestone-bearing tributaries join the Schuylkill. This being the case, the origin of the bad taste and smell was connected to a certain extent with the character of the upper portion, or acid-bearing part of the river, and to be ascribed to other causes than the irruption of sewage and factory waste into the Schuylkill near Philadelphia.

Prof. Leeds sums up the results of his investigations as follows:

"It has been stated previously that the mere fact of sewage contamination is insufficient to explain the taste and smell. The anomalous accumulation of the products of decomposition; the free ammonia exceeding the albuminoid; the reduction of the nitrates to the form of nitrites, instead of remaining in the former form; the deficiency of oxygen in all samples as compared with the normal amount: the completer oxidation of the decomposable organic matter when the samples were allowed to absorb their full complement of oxygen—all of these facts are significant of a different explanation. This is, that the taste and smell were connected with a state of partial and arrested oxidation and of incomplete aeration. Moreover, the bodies which give rise to the unpalatability were products of decomposition of organic substances contained in the water, or deposited at the bottom of the stream, the nature of these bodies being determined by the fact of their being formed by processes of putrefactive decay out of contact with oxygen. Under these conditions it is well known that hydrocarbons belonging to several isologus and homologous series are *formed*, the lower members of which are gases, the members of greater molecular condensation oils, and the highest solids. The most familiar instance is that of marsh gas, which is being constantly liberated from vegetable matter decomposed at the bottom of ponds out of contact with air. Another familiar instance is that of the oil frequently seen floating on the surface in similar localities, and originated in the same way, but differing from marsh gas by greater condensation of molecular structure. When this decomposition occurs under water containing (like that of the Schuylkill River) sulphates, these sulphates undergo reduction, and sulphuretted hydrogen and sulpheretted hydrocarbon compounds are liable to be found, all of which compounds are foul-smelling and ill-tasting.

"While the opportunities afforded me for investigation (the inquiry having been put into my charge only after the crisis of the disorder had passed and the great body of the unpotable water had gone by Fairmount pool) were too limited to permit me to offer the above except as a probable explanation, yet I trust I may not be thought lacking in scientific caution so to do. The explanation accounts for the combustible gases found beneath the covering of ice, and which, according to the testimony of Professor Houston, were in sufficiently large percentage to be set fire to.

"It accounts for the volatile oily bodies so generally complained of, so persistent as to communicate their taste to the food cooked in them, and to diffuse through the house and kitchen their disagreeable odor. It explains their connection between the acid water of the upper Schuylkill and the contemporaneous accession of unpalatability, this upper water, already charged with products of decomposition accumulated in ice-covered dams and canals, being further deteriorated by bodies peculiarly susceptible to putrefactive decay, and to an extent exceeding the maximum limit of permissible sewage contamination in the lower portions of the stream."

A NEW WORK UPON WATER SUPPLY.

"WATER SUPPLY, Considered Mainly from a Chemical and Sanitary Standpoint," by Prof. Wm. Ripley Nichols, of the Massachusetts Institute of Technology. This work is not intended as a text book either for the civil engineer, the chemist or physician, separately considered, but occupies a field which encroaches on these and other professions, but belongs exclusively to no one alone. Its subject matter is of the kind that all who are professionally interested in water supply should be familiar with.

Prof. Nichols first treats in an introductory chapter of the solution of solid and gaseous bodies; the principles involved, the effects produced, and the means of distinguishing between solution and suspension. Chapter I. is devoted to drinking water and the diseases which, with more or less show of reason, are supposed to take their origin from the presence of micro-organisms of various kinds present in the water supply.

Considerable space is next devoted to *water analysis*, with the tests for the detection of chlorine, combined nitrogen, organic matter, hardness, etc. The author has little sympathy with so-called popular tests, and mentions the "sugar test" of Heisch for sewage contamination as the only one of any value.

Succeeding chapters are devoted to rain, surface, ground and deep-seated waters as a source of supply; each class is treated in a separate chapter; and the subject of driven and artesian wells, natural filtration, pollution of domestic wells and characteristics and methods of examinations into the different supplies, is thoroughly discussed.

The concluding chapters are upon the artificial improvement of natural water, by sedimentation, storage and public and domestic filtration, including the chemical softening of hard waters and distillation.

To the hydraulic engineer and to all, in fact, interested in the purity of a water supply, this work of Prof. Nichols must prove of value and professional interest. Our rapidly growing cities and towns are only now awakening to the importance, both from a public and sanitary standpoint, of increasing and improving their water supply; the conditions vary with the location; each must be studied, and none more so than that of our older cities, where the massing of population and vast manufacturing industries have contaminated existing supplies.

This present work is made more valuable by containing a bibliography of books treating of this subject in all its phases, and is illustrated wherever illustration will make the text more clear. John Wiley & Sons are the publishers, a sufficient recommendation for the appearance of the work. Price $2.50.

PERSONAL.

J. D. COOK, consulting engineer of the Board of Water-Works, was recently in Hamilton (Ohio), looking after the construction of the Wilson Hill reservoir.

City Engineer BROUGH, of Toronto, Can., was thrown out of his buggy last Thursday, 12th, and unfortunately broke his thigh. He will be confined to his residence for several weeks.

COL. A. F. WROTNOWSKI, Mem. Am. Soc. C. E., and Eng. of Harbor Improvements at Vera Cruz, Mexico, called at our office this week. The sad occasion of his visit North was the serious illness and ultimate death on May 31 of his wife, a native and late resident of Philadelphia. Col. WROTNOWSKI reports some preliminary work done by the Mexican Government upon the plan of Harbor Improvement at Vera Cruz, suggested by Col. EADS, consulting engineer; but states that lately a French company has obtained a concession on terms more advantageous to the home government, and have commenced work upon a modification of the original scheme, but their first work done not having given satisfaction, there is some doubt of the concession being continued.

NEWS OF THE WEEK.

THE FOREST PARK & CENTRAL road will be finished as far as Creve Coeur Lake this fall.

THE SHERRICK RUN RAILROAD has been chartered at Harrisburg, Pa. It will run from Summit to the Monastery coke works, a distance of 25 miles. The capital is $500,000.

PIPE LAYING.—The city of Keene, N. H., has contracted with Edward Gustine for laying at once 900 ft. of 6-in. water pipe, 1,400 ft. of 4-in., 800 ft. of 2-in., and setting four hydrants on Washington, George, Vernon and Centre streets.

THE CONTRACTS FOR BUILDING THE KENTUCKY UNION ROAD from the Chesapeake and Ohio road to Red River Mills, Powell Co., will be let about Aug. 1. It is intended to have the first section ready by Jan. 1.

THE ST. LOUIS, EMPORIA & WESTERN RAILROAD has a capital of $12,000,000. A contract for building the line has been made with the Missouri and Kansas Construction Company.

THE GRAND CONTINENTAL RAILROAD has issued a circular through its President, who states that all the necessary capital has been subscribed in Europe. The line would be built from Unionville via Grant City to Brownville, Neb., and via Grant City, Mo., Bedford, Red Oak and Council Bluffs, Ia., to Omaha. Hence, the Dakota Branch will be from Unionville, Mo., via Corydon, Osceola, Winterset, Guthrie Centre, Carroll City, Ida Grove, LeMars and Calliope, Iowa; thence to Bismarck, the preliminary survey of which will now proceed and be completed as soon as possible.

THE CONTRACTS FOR WEST SHOE ROAD building at East Buffalo have been let to W. R. & W. Haven, leading contractors of Buffalo, for $120,000, and the planing mill and machine shop was let to Mr. Holmes, of New York, for $80,000. Work on the buildings will commence at once.

COSTLY STRUCTURES TO BE ERECTED.—Plans have been filed in the N. Y. Bureau of Buildings for the erection of the following costly buildings: Messrs. William Wicke & Co., propose to erect a building for a factory and a saw-mill on the northeast corner of First avenue and Thirty-first street, to be six stories high and to cost $175,000. James R. Smith proposes to erect ten buildings on the north side of Seventy-second street, 100 feet east of Tenth avenue, to cost $250,000. Elizabeth Meehan proposes to erect twelve buildings on the east side of Second avenue, between 110th and 111th streets, to cost $216,000. Clinton Sutphen will erect five buildings on the north side of Twentieth street, 275 feet west of Tenth avenue, to cost $60,000. John G. Heintz will erect two buildings on the south side of 127th street, 110 feet east of St. Nicholas avenue, to cost $51,000. Edwin Joyce will erect a building at No. 452 Eleventh avenue, to cost $10,000.

THE BROAD GAUGE REVIVED.—Washington Territory boasts the widest gauge railway yet reported. It is an 8-ft. gauge logging line, running back from Skagit River. The rails are of wood, 8 ft. by 8 in.

BRIDGE CONTRACTS.—The contract for building two abutments over Pusheta Creek, two miles west of Wapakoneta, O., was awarded on the 13th to Messrs. Cunningham & Porter, Middletown, O., at $10.95 per perch for masonry, $23 for lumber and 50c. per cu. yd. for excavation. The contract for the bridge, which is to be a 90-ft. span of iron, will be let on Aug. 9, 1883. The engineer is Samuel Craig, Wapakoneta, O.

FULLERS' EARTH ELECTRODES.—In the use of the electric current for reducing hard ulcers and tumors by electrolysis, a soft electrode of asbestos soaked in saline water is usually employed; but Dr. Apostoli has introduced a paste of fullers' earth with great success. It readily adapts itself to all the sinuosities of the skin and gives an intimate contact. Moreover, it adheres of itself and requires no artificial binding. It dries very slowly, and the current therefore retains its proper strength for a considerable time. Its employment will doubtless be advantageous in other galvano-medical applications.

THE Chicago *Railway Age* publishes statistics of railway building for the first half of the current year. These show a construction of 2,509 miles of main track, not including switches or sidings, on 114 lines in thirty-five States and Territories. During the corresponding period last year 4,990 miles were constructed. In 1881, when 9,300 miles were laid, only 2,300 miles were laid in the first half of the year. The *Age* estimates the construction for the entire year at 8,000 miles. California leads thus far with 200 miles built in 1883; Montana is next with 196; New York, 193; Pennsylvania, 186; Utah, 156; Idaho, 122; and Arizona, 120.

CANAL INSPECTION.—Superintendent Shanahan will make an inspection of the western division of the State next week. A dam costing $6,000 is to be built in the Black River, and another, to cost $20,000, will be placed at Forestport.

BIDS FOR THE NEW HOSPITAL OF THE UNION PACIFIC were lately opened, at Denver. They were as follows: Thomas Neff, $17,200; Hallack & Howard, $19,500; E. F. Hallack, $19,923; A. J. Kelley, $21,180; J. & F. McDonald, $21,884; R. C. Bishop, $23,500; William Morgan, $23,546; C. F. Cochran, $24,000; Vallin & Terrell, $32,000. The bids will be submitted to the general manager of the railroad company before the contract is awarded. The bids for the mason work averaged $7,000. As has been before stated, the building will be erected in Swansea, and will be a handsome edifice. It will accommodate seventy-five patients.

THE SURVEY OF THE SPARTA & ST. LOUIS road is now almost finished. The difference in the elevation of the two points is but twenty feet, the country is comparatively level, and there is but one small creek, so that the cost of constructing the road-bed will be less than the average.

A CONTRACT WITH THE NEW YORK, TEXAS & MEXICAN LINE, to build that line from Rosenberg to Houston has been concluded by Major N. R. Alcott, Chief Engineer of the Louisiana Western. Work will begin at both ends at one.

CONTRACT.—Bids were opened on the 17th by Col. Casey for furnishing 42,000 feet of white marble for the Washington Monument. Hugh Sisson, of Baltimore, was the only bidder, and his offer was $1.50 per cubic foot. He bid the same price at the former letting, but the contract went to the Lee Marble Company, of Massachusetts, at $1.29, who failed to fulfill it. It is expected that work on the monument will be resumed by September 1.

DE LESSEPS' REPORT ON THE PANAMA CANAL.—PARIS, July 18.—The report made by M. de Lesseps at the meeting here yesterday of the Panama Canal shareholders, says that the co-operation of American contractors had dissipated the prejudices existing in certain centers of the United States against his company constructing the canal. The sentiment of equity prevailing among Americans causes them to recognize that those who have undertaken the great work of building the canal across the Isthmus of Panama have no object in view but the removal of a material obstacle to beneficial intercourse.

SPECULATORS TOUCHING IRON.—Tuesday's business in iron on the New York Metal Exchange was the heaviest that has been done there since the Exchange was opened. More than 2,400 tons of iron were sold during the day, and the aggregate value of the sales was about $60,000. The prices ranged at a trifle over $22 a ton. Several Stock Exchange men are now operating in the Metal Exchange, and it was said yesterday that an effort was being made to get up an unusual movement in pig-iron, in the hope that the now dull stock market might be affected thereby.

SALE OF A STREET RAILWAY.—BALTIMORE, June 18.—The People's Passenger Railway, extending from Fort McHenry to Druid Hill Park, was again sold at auction this afternoon, the recent sale having been set aside by the court. It was purchased by ex-United States Senator J. J. Patterson, W. H. Sadler, of Carlisle, Penn., and two Boston capitalists for $106,000. A deposit of $10,000, required by the terms of sale, was made by the purchasers.

THE FLORIDA SHIP CANAL.—JACKSONVILLE, Fla., July 18.—Gen. Charles P. Stone, chief engineer of the Florida ship canal, arrived here this evening from New York. He will personally examine the three routes on which his surveyors have pronounced the construction of a ship canal to be feasible, and will report to the Board of Directors at a meeting to be held in August.

HEAVY DEALINGS IN TIN.—The operators on the New York Metal Exchange were much excited on the 18th over an unusually active movement in tin. The largest amount of business that has ever been done in this Exchange in pig iron was recorded on Tuesday, and yesterday's transactions in tin were greater than ever before in the history of the Exchange. The "call" sales amounted to 210 tons of tin, for which prices aggregating more than $400 a ton were given. The day's transactions in this single commodity amounted to more than $85,000.

WORK OF SANITARY INSPECTORS.—At the meeting of the Board of Health on the 17th, Dr. E. H. Janes, the City Sanitary Superintendent, submitted a report on the operations of the Assistant Sanitary Inspectors of the summer corps for the week ending July 13. It appears that the inspectors visited 3,727 houses, 17,221 families, treated 621 cases of sickness, distributed 1,651 sanitary circulars, and gave away 555 excursion tickets for the St. John's Guild Floating Hospital. Some cases of contagious diseases were found. They were nearly all measles of a mild type. The report of Dr. W. A. Ewing, executive officer of the Night Medical Service for June, showed 20 patients treated. The city paid the legal fee in each case.

Few of the Assistant Sanitary Inspectors of the summer corps in their individual reports related what they observed or commented on the condition of the persons they visited. Dr. A. F. Carrier said that the condition of the Germans he visited was better than that of the Irish and Italians. Dr. C. E. Cross called the attention of the Hebrew Charitable Society to the condition of a woman who was unable to work because of a felon, and her children were in want. Dr. B. G. Cooke remarks that in tenement-houses free circulation of air is difficult, because more than one family occupy each floor. Dr. O. T. Sherman says: "There has been comparatively no sickness for this season." Dr. G. Buffum says: "The tenements in my district are so far in excellent condition for that class of houses, and the tenants seem to be more intelligent, and better able to take care of their children than those down town." Dr. F. J. Kneuper finds the sanitary condition of Nos. 18, 38, 40, and 48 Essex street, and Nos. 45½ and 36 Hester street unsatisfactory, and suggest cleansing, disinfecting and other remedies.

THE MARCH OF ELECTRICITY.—The directors of the American Electric and Illuminating Company met a few days ago in Boston. The report is interesting as showing what is doing in this new industry by one company alone and in one section of the country. The management state that they have so far matured plans for the coming twelve months that orders for the necessary supplies have been placed with the manufactories to supply engines, boilers, dynamos, lamps and copper wire to equip the following plants: 250 lights additional in Boston, making a full 600-light plant in that city; 50 additional lights in Lowell, making 150 there; 50 additional in Fitchburg, making 150 in all; 100 additional in Hartford, Conn., making a 200-light plant there; 50 additional for Cottage City, Martha's Vineyard, making 100 there; 50 additional for Old Orchard Beach, Me., making 100 there; thus aggregating 550 additional lights for plants already established. For new stations now under construction or to be established during the coming year: A 1,000-light station for New York city; a 200-light plant for Providence, R. I.; 150 lights for Worcester; 100 lights for Springfield, 100 for New Haven, Conn.; 100 for Bridgeport, Conn.; 300 for East Boston, Chelsea, Malden and Revere Beach, with central station at Chelsea; 100 for Cambridge and part of Somerville; 100 for Lawrence; 100 for Nashua, N. H.; 100 for Manchester, N. H.; 100 for Saco and Biddeford, Me.; 100 for Portland, Me.; 100 for Lewiston; Me.; 100 for Augusta, Me.; and 100 for Bar Harbor, Me., making an aggregate of 3,400 lights in central stations, besides several smaller stations talked of, and a number of isolated plants for mills, shops, etc. The material required will be about 150 25-light dynamos, 75 50 horse-power engines, and at least 600 miles of copper wire.

BACK VOLUMES OF ENGINEERING NEWS.—C. J. Roney, of 2,125 Indiana avenue, Chicago, Ill., has vols. 1, 2, 3, 4, 5, and first half of 6, of ENGINEERING NEWS, unbound and for sale; also, one copy American edition of Baldwin Latham's "Sanitary Engineering;" also, odd numbers of ENGINEERING NEWS of vols. 2, 3 and 4. Parties desiring any of the above address him direct and soon, as he is going to Colorado to live.

One copy of Baldwin Latham's "Sanitary Engineering," American edition, is for sale by Wm. Paul Gerhard, 187 Broadway, New York City. Address him direct.

SCITUATE HARBOR IMPROVEMENTS were lately visited by a number of officials. The chief engineer, Major Raymond, was in attendance. The first breakwater across the mouth is nearly finished. A second brakewater is soon to be begun.

THE EAST SIDE AND WEST SIDE SCHUYLKILL RAILWAYS have been chartered. The surveys have been completed. They will give the Baltimore & Ohio an entry into Philadelphia.

OSHKOSH (WIS.) WATER-WORKS.—This enterprising city is earnestly moving for a public water supply.

CLEBURNE (Texas) AUTHORITIES HAVE A WATER-WORKS estimate before it. It is proposed by the company to build works and rent them for 16 years at $4,000 per annum.

THE KENTUCKY UNION line has been surveyed. Hedges' Station will be the western terminus of the road. The chief engineer's quarters are there, and work will be begun within a month.

THE INSULITE BATTERY.—A useful form of battery has been brought out by the British Insulite Company, Limited. The cell is sealed, and therefore can give off no fumes into a house where it may be employed for bells or other purposes. The outer vessel, which is rectangular, is made of insulite, a material impervious to liquid and self-cementing. A partition of porous clay is cemented diagonally across the cell from corner to corner. In one corner is a zinc rod, and in the other is a carbon rod surrounded by pea-like pieces of carbon. A special solution is employed to excite the battery. The connections are made by binding screws on the lid, in which there is also a release

valve to provide for expansion of the air within. The cell, when sealed, can be inverted or put in any position without damage. The battery lasts two years without renewal of zinc, and is well-fitted for bell-work.

THE contract for the new capitol at Lincoln (Neb.) has been given to W. H. B. Stout. There were only two bids, one by Mr. Stout at $439,189, and one by Mr. Silver at $398,000. The lower bid failed to comply with the conditions.

THE water-works at Salina, Kan., will soon be completed.

THE Susquehanna & Southwest Railway Co. has given a mortgage of $4,050,000 to the Central Trust Company, of New York. It is proposed to build a line from Sunbury to Hancock (Md.). The length is 135 miles.

A RAILROAD IS TO BE BUILT between San Benito and Tapachula, Mexico, by Manuel Saavedra, who has signed a contract with the government.

THE MATAMORAS & MONTEREY road is being built rapidly.

A LINE FROM ZACATECAS to the northern boundary of Mexico is about to be built by the Central & Southern Railway Company.

THE HAMILTON (O.) WATER-WORKS.—The act authorizing the building of water-works in Hamilton provides that the city may issue bonds and raise money to an amount not exceeding $300,000. Now come the trustees and, in their petition, sworn and filed, declare that they have already "made contracts for the purchase of real estate and construction of water-works to an amount exceeding $300,000." Are not all contracts made in excess of $300,000 illegal?

ONE HUNDRED ITALIANS recently struck at Celina, O. They were grading the Cincinnati, Van Wert & Michigan Railroad. Several of them threatened to burn the town if the contractors did not come to terms.

BRIDGE CONTRACTS.—The Penn Bridge Company, of Beaver Falls, Pa., has the contract for the superstructures of two iron bridges of 140 ft. and 115 ft. span, being built over Middle Island and McElroy creeks near Ripley's, Tyler County, W. Va. The stone work contracts are let to Samuel Keenan. The bridges will cost $20,000.

AN OHIO NARROW GAUGE.—W. H. Watson of the Civil Engineer Corps on the Connotton Valley Railroad, has been locating between Massillon (Ohio) and a point on the above road. It is proposed to build a narrow gauge line.

THE CINCINNATI, VAN WERT & MICHIGAN ROAD is advancing rapidly. Large gangs of men are at work between Celina and Greenville.

THE SPARTA & TILDEN ROAD has been located and is ready for the graders.

THE DELAWARE, LACKAWANNA & WESTERN has issued an order that it will not in future employ any person under twenty-one years of age. This is owing to the special liability for accidents to minors.

THE SURVEYS on the Oregon & California Railroad have been abandoned, and the old surveying corps disbanded. New preliminary and location surveys are now being made from the terminus near Redding to the Oregon line, under the direction of Mr. Hood, Assistant Engineer of the Southern Pacific Railroad. The abandoned surveys are said to have cost the railroad company about $100,000. It will take Mr. Hood at least eighteen months to finish the new survey, which is being conducted with great care. The country through which the survey is being made is one of the most difficult yet encountered by railroad engineers in this State. In many places all the work has to be done in ropes, the bluffs forming the sides of the valley being nearly perpendicular. The benches on the river banks cannot be utilized, for the reason that they are subject to overflow during the flood season. In the meantime, the reports from Oregon show that the Villard system is being pushed with great vigor, although the engineering obstacles encountered greatly impede the progress of the work.

COMPLAINTS ARE MADE OF THE OBSTRUCTIONS caused by the many bridges on the Mississippi River.

END OF A BRIDGE CONTRACT SUIT.—A decision has been given by Judge Blodgett, in the United States District Court for the Northern District of Illinois, which provokes a wide interest. In the early part of the year 1876 the electors of the towns of Utica and Deer Park, Ill., voted to borrow money to build a bridge across the Illinois River. The Highway Commissioners at the two towns entered into a contract with a bridge company for the iron superstructure. The bridge was completed according to contract and the towns refused to pay. Suit was instituted, but the Supreme Court of Illinois decided that the towns were not liable, A bill was then filed by the bridge company in the Federal Court asking to be allowed to take down and remove the bridge, on the ground that the company had erected it under a mistake of law and fact. Judge Blodgett said they were equitably entitled to this relief, and entered a decree in the company's favor to that effect, unless the towns pay the amount claimed in ninety days.

THE HAVERHILL (MASS.) WATER SUPPLY is insufficient. The Haverhill Aqueduct Co. is about to lay pipes from Crystal Lake—a distance of four miles.

THE THIRD IRON BRIDGE OVER THE RIO GRANDE was lately put up at Eagle Pass by the Mexican National Railway.

EVANSVILLE (IND.) HAS THE ELECTRIC LIGHT, and it is said to be very satisfactory. The light comes from ten towers 150 feet in height.

THE BALTIMORE & OHIO ROAD PROPOSES TO BUILD A BRIDGE over the Susquehanna at Port Deposit. It is to be 80 feet above high water, without a draw, but the citizens oppose it without a draw.

THE SURVEYS FOR CAPT. EADS' SHIP RAILWAY canal are progressing rapidly. In 80 kilometres, the greatest gradient is 1 in 101 kilometres.

THE RAILROADS BUILT during the first half of the present year were 2,509 miles of main tracks as against 4,690 miles for corresponding period of last year. California built 200 miles; Montana, 169; New York, 193; Pennsylvania, 186; Utah, 156; Idaho, 122, and Arizona, 120.

THE ROUTE OF THE FARGO & ST. LOUIS will be be from Fargo through Wahpton and Bois de Sioux and enter Minnesota near Lake Traverse, running through Graceville, Ortonville and Fort Dodge, Iowa. The road will be put under contract immediately.

THE MINNEAPOLIS CIVIL ENGINEERS' CLUB.—At the regular monthly meeting, held last Friday evening, a paper was read by Mr. William De la Barre, on the manufacture of wrought-iron pipes. He said there was 135 miles of pipe used daily in the United States. This is now all manufactured in this country, whereas, before the war, it was all imported from England. He described in detail the process of manufacture.

A NATIONAL SEWERAGE COMPANY.—In the County Clerk's Office, New York, there was filed on Tuesday the certificate of incorporation of the National Sewerage and Sewage Utilization Company. The capital stock is $3,600,000, divided into shares of $100 each.

NEW BUILDINGS.—Mr. Orlando B. Potter has filed a plan in the Building Bureau for the erection, on the site of the old *World* building, corner of Park row, Beekman and Nassau streets, of a building for office and store purposes. The building is to be eleven stories high, ninety-six feet and nine inches front by 144 feet eight inchet deep, and to cost $700,000. Plans were also filed for the construction of the following new buildings: For two buildings at 1,237 and 1,239 Broadway, to cost $60,000. E. F. James is the owner. For two new buildings on the south side of Forty-seventh street 330 feet west of Eighth avenue, to cost $34,000. Frederick Schenck is the owner. For a building for manufacturing purposes in the interior of the block bounded by Forty-sixth and Forty-seventh streets, and Eighth and Ninth avenues, to cost $25,000. Same owner. For three dwellings at Nos. 515-519 west Fifty-second street, to cost $46,000. Ellsworth L. Striker is the owner. For a building on the south side of 128th street, eighty feet west of Fifth avenue, to cost $12,000. H. M. Edmonstone is the owner. For four buildings on the west side of Fifth avenue, twenty feet south of 128th street, to cost $60,000.

THE IRON AND METAL MARKET

PHILADELPHIA, JULY 20.

The iron trade shows encouraging activity and firmness, notwithstanding the fact that the present season is one when buyers and sellers are making no special efforts to do business. Inside quotations are: No. 1 Foundry, $22; No. 2, $19.50; Gray Forge, $18.50; Bessemer, $21.50; English and Scotch, nominal; Muck Bars, $34.50; Merchant Bar, 2.15c.; Nails, $3; Steel Rails, $38. Outside quotations are for foundry irons; No. 1, $23.50, and for No. 2, $21, and $19 for Forge. Inquiries are in hand for from 60 to 90 days' requirements, but transactions will scarcely be closed, as views are so far apart. Merchant iron is quite active in a retail way, but the large consumers are holding back. Railway material is in active request, and large transactions will be closed this month for winter delivery at less than $38, according to rumors.

PITTSBURGH.

An improving inquiry has developed this week in the Western Pennsylvania iron market, and there is a strong demand for both crude and finished iron; the activity is due to the fact that stocks of both crude and finished iron in consumers' hands, were unwisely permitted to fall very low, and buyers are therefore somewhat concerned lest an unexpected upward tendency should show itself and find them short. Foundry irons sell at $18.50 @$20; Forge, $17.50@$18.50; Bessemer, $21.50; Muck Bars, $34.50. Offers for old rails have been made, and may be accepted during next week. Outside makers are well supplied, but Allegheny County furnaces have been able to undersell them thus far. A number of mills are idle, but some of them will soon resume. The four weeks' suspension in the nail mills began last Monday. Prices are firm, and an active fall trade is assured. Steel rail orders were booked at $38. Small material is active. All kinds of sheet iron, boiler tubes, pipes and plate iron are in fair demand for the season, and mills are taking an average amount of business.

CHICAGO.

Manufactured iron is improving steadily. A good many mills are running on short time. Foreign finished irons are fairly active. Nails are firm at $3.05@$3.15. Stocks are light. A further improvement has taken place in pig iron, and the market is more aggressive. Charcoal irons are scarce. Ingot copper, 15¼c.; merchant steel is in improving demand. Western mills are taking steel rail orders at $40. Pig lead, 4.15c. The hardware trade is improving for season goods. Shelf hardware is dull. The outlook for the iron trade in the Northwest is not encouraging. Large consumers will not place fall orders until they can determine the probable course of the market.

CONTRACTORS' SUPPLIES MARKETS.

NEW YORK, July 20.—The lumber market continues dull, but the requirements for future contracts help to keep the market firm. A great deal will depend on the tone of the fall market. There is a good stock of eastern spruce on hand, as there have been many arrivals lately. The same remark applies to white pine. The following are the latest quotations:

Spruce—Random cargo, per M feet	$13.50@$16.00
Spruce—Special cargo	14.50@ 17.00
White pine—S. Amer'n shippers, per M feet	28.00@ 30.00
White pine—West India shippers	18.00@ 20.00
White pine—Box boards	16.00@ 18.00
Yellow pine—Random cargo	19.00@ 22.00
Yellow pine—Special cargo	20.00@ 22.00
Yellow pine—Green flooring boards	22.00@ 23.50
Yellow pine—Dry flooring boards	23.00@ 24.50
Yellow pine—Plank	24.00@ 25.00
Yellow pine—Cargoes f. o. b. at At. ports, rough	13.00@ 14.50
Yellow pine—Cargoes f. o. b. at At. ports, dressed	18.00@ 20.00
Yellow pine—Cargoes f. o. b. at Gulf ports, rough	12.00@ 13.50
Yellow pine—Cargoes f. o. b. at Gulf ports, dressed	17.00@ 18.00

Shingles do not show any great variations; Cypress, $8 per M, for 5x20; 6x20 remains the same, $10. Machine-dressed cedar are quoted $15 to $20 for 30 inch A, and $28.50 for No. 1; $10.50 @ $15 for A, 24 inch, and $15 @ $20.50 for No. 1. The Albany *Argus* gives the following for shingles and ordinary used woods:

Shingles, shaved pine, per M			@ $6.50
Shingles, shaved pine, 2d quality, per M			@ 5.00
Shingles, sawed pine, extra			$4.80@ 5.00
Shingles, sawed pine, clear butts, per M			@ 3.30
Shingles, cedar XXX, per M			@ 4.50
Shingles, cedar mixed, per M			@ 3.50
Shingles, hemlock, per M			@ 2.60
Lath, pine, per M			2.25@ 2.50
Lath, spruce, per M			@ 2.25
Lath, hemlock, per M			@ 2.00
Pine, good, 2½ in. and upward, per M			$55.00@ 60.00
Pine, 4ths,	do	per M	50.00@ 55.00
Pine, selects,	do	per M	45.00@ 50.00
Pine, pickings,	do	per M	40.00@ 45.00

BRICKS remain at same rates. Cargo prices are:

Pale, per M	$3.50@ 3.50
Jerseys	5.50@ 6.00
Up Rivers	5.50@ 6.25
Haverstraw Bay, 2ds	6.25@ 6.50
Haverstraw Bay, 1sts	6.75@ 6.87
Favorite brands	7.00@ ....
Hollow Fire Clay Brick	9.00@ 9.25

FRONT bricks are quoted $13 @ $15 for Croton; Philadelphia and Trenton, $27.

FIRE bricks quotations are:

Welsh	$32.50@$35.00
English	28.00@ 40.00
English, choice brands	45.00@ 46.00
Scotch	45.00@ 46.00
Newcastle	30.00@ 32.00
Silica, Lee-Moor	30.00@ 40.00
Silica, Dinas	50.00@ 55.00
White Enameled, English size, per M	95.00@ ....
do do domestic size	85.00@ ....
Warm Buff facing, domestic size	45.00@ 50.00
American, No. 1	33.00@ 37.50
American, No. 2	25.00@ 30.00

The market for cement, nails, paints, etc., shows but few variations.

THE NORTHWESTERN LUMBER SUPPLY.—There has been a falling off in the receipts at the Northwest of some 18,202,000 during the six months.

It is estimated that 455,000,000 feet of the logs on the Mississippi tributaries will be hung up as follows: Chippewa, 250,000,000; Black, 75,000,000; Wisconsin, 50,000,000; St. Croix, 40,000,000; Upper Mississippi, 40,000,000. The lumbermen on the Lake Michigan streams have been more successful, and probably not more than 500,000,000 of the 4,000,000,000 feet dropped will fail of being available.

TRUSS BRIDGES.

AN ILLUSTRATED HISTORICAL DESCRIPTION OF ALL EXPIRED PATENTS ON TRUSS BRIDGES, WHICH UNDER THE LAW ARE NOW PUBLIC PROPERTY AND FREE TO BE USED BY ANY ONE.

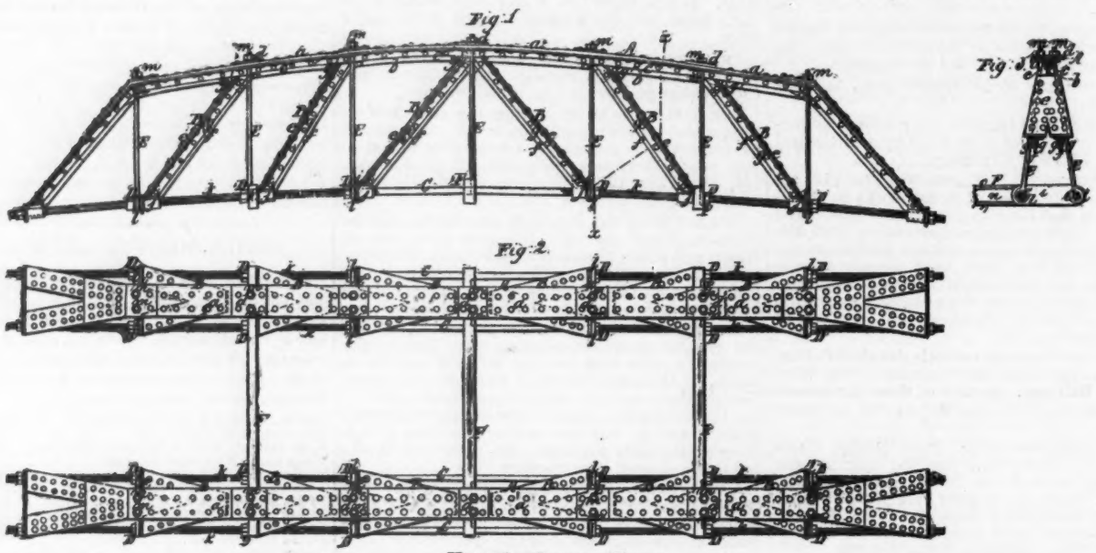
By F. B. Brock, Patent Attorney, Washington, D. C.

The next invention here considered is that granted George Heath, May 27, 1862.

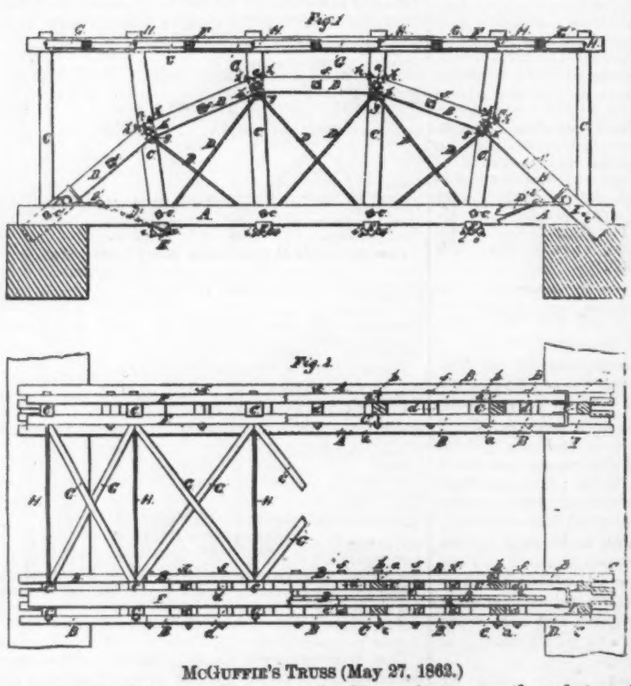
A represents the straining beams of the bridge which are composed of wrought iron plates *a* having vertical webs *b*, secured centrally to their underside by angle irons *c*. The braces *B* are of *V* form, and are secured at their lower ends on the chords *C* by means of lock-nuts *D* fitted on screw threads *k* cut on the chords.

The vertical rods *E* terminate in eyes *Z*, through which the chords *C* pass. These rods *E* are between the plates *i* and the nuts *D*, which firmly hold the rods in proper position and resist the thrust of the braces *B*. As the braces are forked it will be seen that two chords are required for each straining beam, and two vertical rods for each brace. These braces have an inclination of 45° and are arranged in reverse positions on the opposite side of the bridge.

In consequence of having the braces *B* constructed as shown, they are adapted to resist horizontal or lateral strain, and in connection with the vertical rods *E* resist vertical strain, the braces and rods rendering the bridge extremely efficient in that respect. The forked form of the braces prevents any lateral swaying of the bridge. By reversing the braces, as in Fig. 1, the longitudinal strain is resisted in both directions with the employment, it is claimed, of comparatively little material, the double diagonal braces hitherto employed in many bridges for that purpose being dispensed with.



HEATH'S BRIDGE TRUSS.



McGUFFIE'S TRUSS (May 27, 1862.)

A. McGuffie's next invention was for combining wooden arch segments, posts and chords, with wrought iron angle braces.

The lower chord and the arch sections are of shaft timbers, the latter abutting against each other where they are secured by bolts *b* passing through the posts. The posts themselves are connected to the lower chord by bolts *c*, and are notched between the chord timbers. The arch is stiffened laterally by means of blocks *d* between the chord stringers.

D are angle braces for bracing the arches. These may be connected with the arch at its intersection with the posts either by means of inverted stirrups *g* and nuts *h*, or by means of blocks applied between the posts, and nuts applied above the said blocks. The braces run from the intersection of one post with the upper chord, to the foot of the next post on either side of it. The cast-iron shoes *I* on the end timbers *B* of the arch may be secured by straps *g'* and *D'* applied in the form of a stirrup. These shoes resting on the abutments relieve the bottom chord of pressure and of all strain but a tensional one, and throws all the weight of the bridge on the arch.

The patent of McGuffie is dated May 27, 1862.

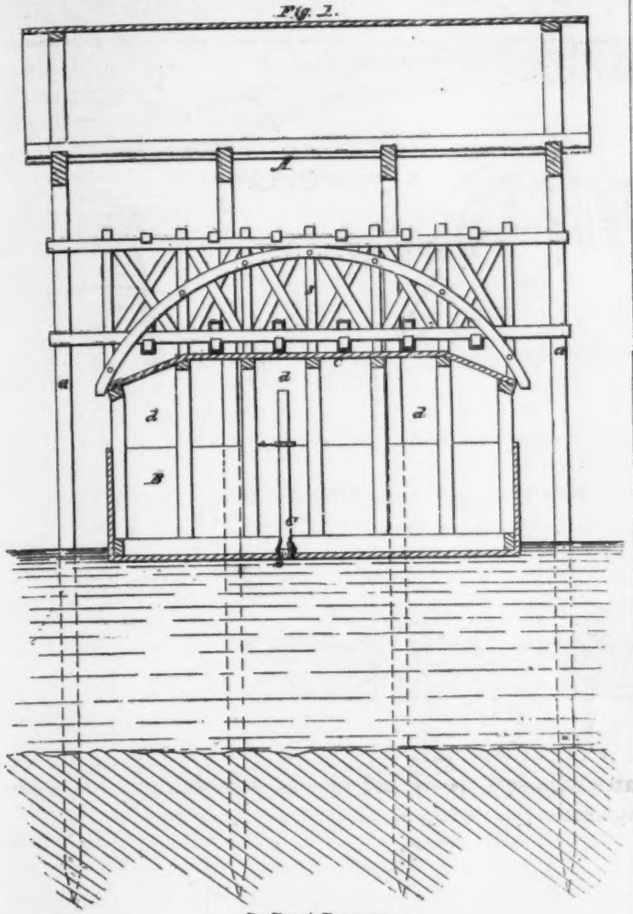
John Du Bois, in his application for a patent October 7, 1862, states that in the ordinary way of building bridges, the different parts require to be erected on the spot where the bridge is to be located. He also states that there is much inconvenience in the removal and replacement of any section of the bridge by the ordinary methods.

Du Bois' invention may be said to be designed to avoid difficulties like those above enumerated; his construction allowing the whole span to be erected at once, and from thence carrying it to the piers which are to support it.

To carry his invention out, he first erects a substantial work shop over the surface of a river, by driving long piles *a* down into the river-bed, and upon which is built a roof, with a high floating foundation *B*, under it. This float has a valve *C*, fitted in the bottom of the water-tight hollow

floating foundation. The span is built upon the floor *d* of this float, and when finished is towed to the piers or abutments upon which it is to rest. When the span and float is in proper position at the piers the valve *C* is opened

Fig. 2.



DUBOIS' BRIDGE.

so as to lower the foundation and set the bridge span upon the abutments. In the setting of the bridge, the rise and fall of the tide, if any, may be also depended upon to a considerable extent.

and supported upon wooden "spiles." These columns support iron girders, on which an arched flooring of masonry rests, the flooring being covered with sand or cement, on which a stone pavement is to be laid. *B* are the columns filled with cement *C*. They are placed in rows to support the girders *D*, slightly arched, and of *I* section. Lighter girders *E* are laid upon girders *D*, and the spaces between filled with arches of masonry *F*.

By this mode of construction it is claimed a durable pier and bridge is obtained. There are no combustible materials used in its construction. The cast-iron columns at the sides extend upward above the others sufficiently high to retain in proper position the stone curbs *K*.

Isaiah Rogers appears again in 1863, as the patentee of a truss bridge, the letters patent being dated Feb. 10.

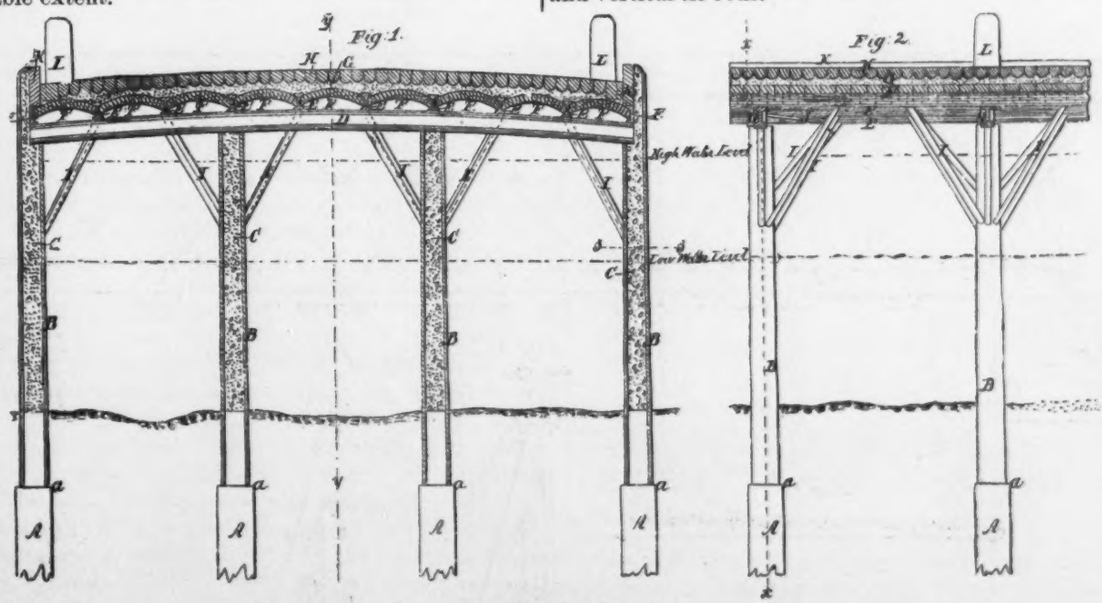
A peculiar combination of arched flanged tubes and connecting plates is effected in this construction. A novel device is also employed for sustaining the thrust between the adjacent arches.

Iron tubes *A*, having longitudinal flanges *a*, which impart additional rigidity are used. These flanges afford a means of attachment of the iron plates *B* thereto, by the use of the bolts *C*.

A single arch *D* is first erected on a suitable scaffold formed of tubes *A*, placed end to end. This arch when built constitutes a scaffold to assist in the erection of the adjacent arches *E*. A second and third pair of arches are then built, each successive pair being spread further apart at the base and converge toward the apex so as to give great lateral strength, the outer arched tubes constituting powerful horizontal braces.

The device for sustaining the vertical thrust of the arch in places where the use of a draw-bridge, with sufficient depth of water for the passage of vessels, renders an immediate bearing or abutment between impracticable, consists in forming an inverted arch as shown at *L* beneath the channel and extending from base to base of the two adjacent arches, with such a gradually changing curve as may afford a solid bearing.

The nature of John Boles, Jr.'s, invention (May 19, 1863) consists in the arrangement of a series of concentric overlapping "annuli" combined with top and bottom chords and vertical tie rods.



WOOD'S BRIDGE.

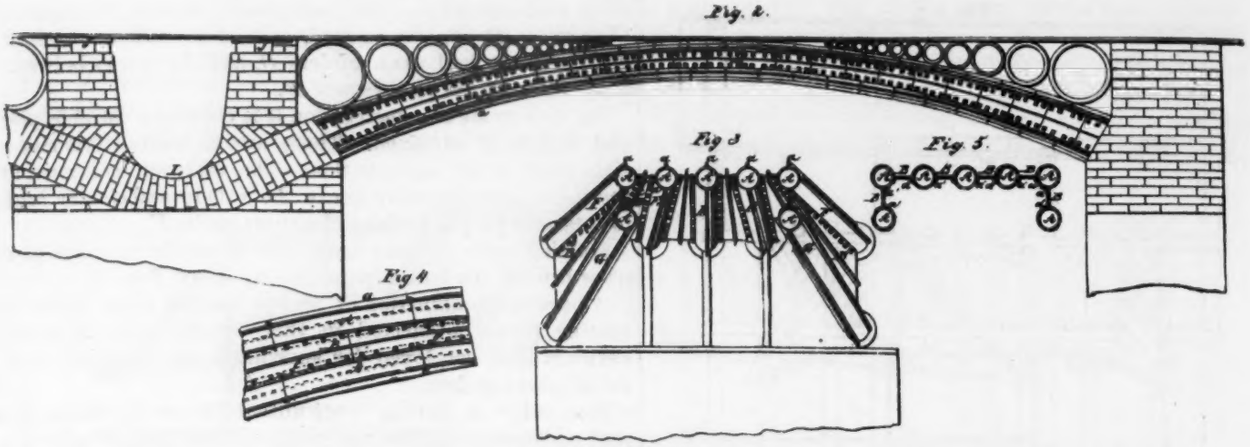
The object of Wm. H. Wood's invention is to construct piers and bridges in such manner that they will be very durable, "equally so as stone." To this end, Wood uses hollow cast-iron columns, filled with concrete or cement,

In the cuts *A* and *B* represent the top and bottom chords; *C*, *B*, etc., are the annuli. *E* are the vertical tie rods, and *F* the arched beams.

The "annuli" are arranged in sets of different diame-

ters, disposed concentrically. Each of these sets, except the two end sets of the collection, are also arranged so as to lap on two other sets. Where each annulus of one set crosses any one of another set, it may interlock with it, or may be secured by bolts. Each ring is preferably made of angle iron, in which case they may be notched at their crossings, so that when put together they will interlock. The truss exhibits two ranges of these sets of rings interposed between two chords, the latter being made so as to project between. Between the two ranges is the arched beam *F*, which, at its extremities, may abut on the lower chord. The truss is finished by the employment of posts *H* at its ends and between the chords.

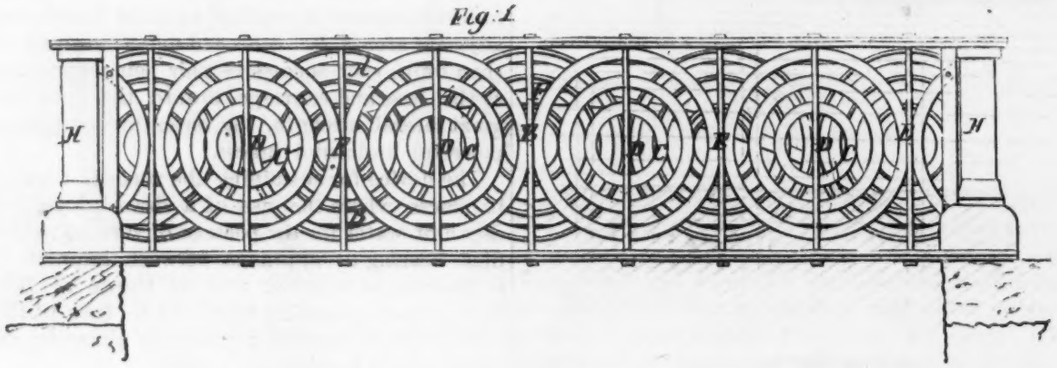
Fig. 2.



ROGERS' BRIDGE.

John C. Briggs' truss bridge is, in its general features, a "lattice" bridge, and was patented May 26, 1863.

Fig. 1.



BOLE'S BRIDGE.

The braces *b* are footed upon the chords and away from the abutments, bevel blocks *v* being used for that purpose.

Fig. 1.

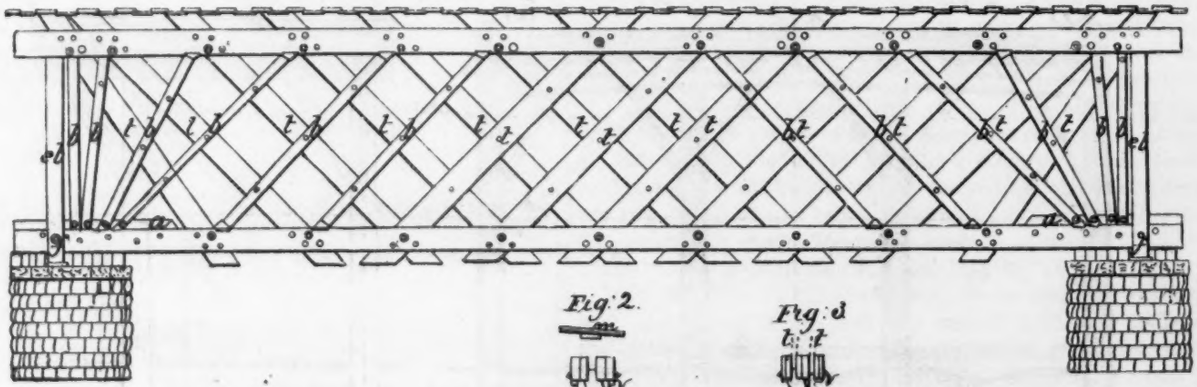


Fig. 2.

Fig. 3

Fig. 6

Fig. 4

Fig. 5.

BRIGGS' BRIDGE.

Figs. 4 and 6 represent a longitudinal section through a rib *r* of the roof of the bridge. The roof boards are laid lengthwise in the direction of the water shed.